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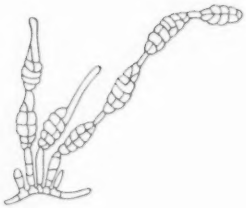

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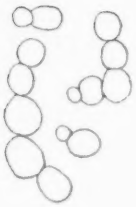

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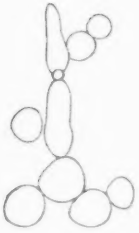

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THE

AMERICAN JOURNAL OF MEDICAL TECHNOLOGY

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A BRIEF REVIEW OF METHODS FOR DETERMINING URINARY AMINO ACIDS WITH EMPHASIS ON NEWER TECHNIQUES*§

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The amino acids of urine have been studied for many years because of their role in protein metabolism. Amino acids occur in the urine in their free form and also in combined forms. The earliest methods which were described measured total urinary amino nitrogen which included the amine nitrogen of free and bound amino acids as well as the amine nitrogen of purines, pyrimidines, and aliphatic amines. These early methods were those of Sorensen,[1] Northrup,[2] Van Slyke and Kirk,[3] and Folin.[4] In 1943 Van Slyke, MacFayden, and Hamilton[5] applied the ninhydrin-carbon dioxide manometric method of measuring free amino acids to urine. This method is the best available method for the measurement of free alpha amino acids in urine because it is specific for free alpha amino groups. The underlying principle is that when alpha amino acids are boiled with ninhydrin (triketohydrindene hydrate) at a pH 1-5, the carbon dioxide of their carboxyl groups is evolved quantitatively. In order for the reaction to occur, both the amino group and the carboxyl group of the amino acids must be free. Thus, the method is specific for free amino acids. It has been used on a limited scale for determination of the quantity of free alpha-amino acids and of total alpha amino acids after hydrolysis of urine in normal and pathological urines. Normal values have been reported as 118-204 mg. per 24 hrs. for free amino acids with an average threefold increase after hydrolysis.[7]

In 1944 Albanese and Irby[6] described a method in which copper complexes of the amino acids are formed and measured. Normal

* The experimental work referred to herein was included in a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science from the University of Minnesota.

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values of 226-693 mg. per 24 hrs. indicate that this method measures more than free amino acids.

As knowledge of protein metabolism increased it became important to know the quantities of individual amino acids occurring in urine. Methods were described which attempted to differentiate the various amino acids on the basis of colorimetric reactions of certain groupings rather than the whole compound; thus the methods were usually not specific for amino acids alone.

In 1943 microbiological assay was introduced for the quantitation of individual urinary amino acids. The usual technique is to prepare two sets of tubes containing a basal medium which contains all but one of the amino acids essential to the growth of a given microorganism. To one set of tubes, the standard set, the missing amino acid is added in known graduated amounts. To the other set of tubes, the unknown set, the sterilized urine which is being tested is added in graduated amounts. To both sets of tubes the microorganism which requires the amino acid for growth is added. After suitable incubation the amount of growth in both sets of tubes is measured by turbidity or titration of the acid produced. If the urine under investigation contains the amino acid which was lacking from the basal medium, growth will have occurred in the unknown set of tubes and the quantity of this amino acid in the urine can be judged by comparison with the standard set of tubes. By use of this method the amounts of arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, trytophan, tyrosine, and valine have been determined in unhydrolysed urine and all but cystine and serine have been determined in hydrolysed urine.[8,9] The technique is inexpensive and easily performed but does have some drawbacks. Some microorganisms are able to use bound as well as free amino acids in their metabolism; urine contains large amounts of urea and ammonia which are inhibitors to bacterial growth; and for certain microorganisms some amino acids are antagonistic or interdependent.

The next technique to be applied to study of urinary amino acids was that of paper chromatography.[10] Basically chromatography separates amino acids on the basis of their different solubilities in a variety of organic solvents. The urine to be analyzed is placed in a small spot a short distance from the edge of a large rectangle of filter paper. The edge is then dipped into a pan of organic solvent and the solvent rises in the paper through capillary action. After the solvent has traveled a sufficient distance up the paper, the paper can be removed and treated with a reagent to make the amino acid spots visible. This separation in one direction is called the one-dimensional technique. Identification of the amino acids is done by comparison with known

amino acids treated in the same way. For better separation the two dimensional technique is frequently employed. After the paper has been in contact with the first solvent, it is removed, dried, turned at right angles and a second edge is then immersed in a second solvent. After a sufficient time in this second solvent, the paper is treated with the color developing solution. Again identification of the amino acid spots is done by comparison with standard amino acid maps. Quantitative results have been reported by comparing the intensity or areas of the spots isolated from urine with a series of standard spots, by eluting the colored spot from the paper and measuring the amount of color in a colorimeter, and by adding standard to unknown and comparing the color with that of a standard spot alone.[10,11] On a quantitative basis, paper chromatography is quite limited in usefulness but on a qualitative basis it has proved to be extremely useful.

In 1948 Stein and Moore described a technique for the quantitative separation of amino acids from a mixture by the use of starch chromatography.[12] Starch replaces paper as an essentially inert support for the partition of the amino acids in the organic solvents. Stein and Moore indicated an application of their technique to urine but gave no detals of their method.[13] In our laboratory a study of the amino acids in urines from normal people was undertaken using both starch and paper chromatography.

Twenty-four hour urine collections were made by normal subjects on ad lib diets. Ultrafiltrates of the urine were prepared by centrifugation through collodion membranes. Although there are only minute amounts of protein in normal urine, this step was considered necessary with the normal urines in order to control adequately later work with pathological urines. Electrolytic desalting was done and the desalted specimens were concentrated with mild heat and vacuum so that one cc. contained 0.4-0.5 mg. of alpha amino nitrogen as determined by the Van Slyke, MacFayden, and Hamilton manometric ninhydrin method.[5] A portion of the ultrafiltrate of each specimen was hydrolyzed for 24 hrs. with an equal portion of concentrated HCl and the hydrolysate was desalted and concentrated as above. Columns of starch were prepared in butanol according to the method described by Stein and Moore and to these columns an aliquot of the desalted concentrated ultrafiltrate or hydrolysate containing 0.2-0.25 mg. alpha amino nitrogen was added. The column was mounted over an automatic fraction collector,[12] a reservoir of organic solvent mixture was attached, pressure was applied, and fractions of 0.5 cc. volume were collected. Approximately 330 fractions were collected for each unknown and alternate fractions were treated with ninhydrin in a photometric method for determining amino nitrogen concentration.[14] The concentration thus obtained was plotted against the volume at which the fractions emerged. The

curve showed a similar pattern of ten peaks for all the unknowns. By adding up the points under each peak the total amount of amino nitrogen therein could be found. Since a known proportion of the total daily alpha amino nitrogen excretion was applied to the column, the total daily amount of amino nitrogen falling in each peak could be calculated. Identification of the material in each peak was done by comparison of the urine patterns with the pattern of a mixture of pure amino acids, by addition of a pure amino acid to a duplicate aliquot of urine run on a column and recovery of the added amount in a given peak, by paper chromatography of the ultrafiltrates and hydrolysates and by paper chromatography of the pooled unused fractions collected by the fraction collector. Aliquots of these pools containing 2-5 micrograms of amino nitrogen were run on paper next to duplicate aliquots to which was added an amino acid suspected of being present. If this amino acid were present the unknown and standard spots were superimposed, whereas if it were not present two spots appeared. By such techniques we were able to identify leucine and/or isoleucine, valine, tyrosine, alanine, threonine, taurine, serine, glycine, glutamine, lysine, and histidine in unhydrolyzed urines. After hydrolysis aspartic acid and glutamic acid appeared and glutamine disappeared. These amino compounds did not all appear as separate peaks and consequently the quantitative results cannot be expressed in terms of specific amino acids. The patterns, however, can be compared with one another on the basis of the amino nitrogen content of each peak because of the similarity of all the patterns. The urines from six normal subjects, three males and three females, were used in this study. The results from the chromatograms of hydrolyzed urines showed an increase in all of the peaks, indicating the excretion of bound amino acids. The quantitative results from the six patterns from unhydrolyzed urines agreed well with one another as did those from the hydrolyzed urines; the peaks which were shown to contain more than one component showed the widest variation in the quantity of amino nitrogen present. The work which was done with this somewhat elaborate tool of starch chromatography indicates that it can be a useful means of separating amino acids quantitatively. It offers advantages over microbiological techniques in that interfering substances are eliminated and bound amino acids are accounted for in the hydrolyzed urines. It offers advantages over paper chromatography in the ease with which quantitation can be done and the adaptability of the technique to collection of large fractions of separated amino compounds. It is not at present a technique which will be used routinely in clinical work but in basic science it has shown promise as a useful tool.

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STAINING CELLOIDIN EYE SECTIONS ON SLIDES

AILEEN C. SEVIER

Celloidin embedding is preferable to other methods for certain tissue because there is less shrinkage, and the minute details of cellular structure are better preserved. Loose membranes and fragile or brittle areas in the tissue are more easily kept intact when embedded in celloidin.

The dry celloidin is the method of choice for eye structures, whereas the wet method is successful for tissues such as brain, tumors, teeth, or bone. In the dry celloidin method the block embedded may be sectioned on either sliding or rotary microtomes at any desired thinness, either serially or in routine manner. Serial sections can be kept in order by using numbered slips and picking up the sections as cut or in groups.

Procedure for Staining Celloidin Eye Sections on Slides

An objection to the dry celloidin method is the amount of time

*American Society of Medical Technologists Annual Meeting, Portland, Oregon, June 22-29, 1952.

consumed in the staining of individual sections. However, if the unstained sections are first affixed to slides they can be run through the solutions in racks, just as paraffin slides. Such a procedure may be used for specific stains, and it has proved satisfactory for routine diagnostic work. Only when some questionable point in the identification of minute detail arises is it preferable to resort to staining of individual sections. A description of the method used for staining celloidin eye sections on slides at the Armed Forces Institute of Pathology follows:

1. Remove cedar wood oil or clearing agent from celloidin sections in 95 percent alcohol.

2. Float section onto slide coated with albumin and blot firmly but gently; coat very thinly with collodion.

3. When slightly dry (so that a film may be seen) place slide in 70 percent alcohol.

Stain as for individual celloidin sections and do not attempt to remove the collodion.

The collodion for coating must be thinned before each application, and it seems to be impossible to make the mixture too thin. These slides may be used for special stains that do not involve heating or clearing in absolute alcohol. Timing in various solutions is best worked out on a few trial runs.

The great economy of time that results from this procedure is an advantage that requires no further comment. Naturally there are some disadvantages, but with reasonable care they can be overcome. The chief difficulties seem to lie in (1) the affinity of albumin for stains when covered by collodion; (2) obtaining uniform differentiation of sections with penetration of acid alcohol through the collodion from one side only; (3) blotting evenly and applying a sufficiently thin collodion coating.

The use of synthetic albumin somewhat lessens the affinity of albumin for stains, if the solutions are kept very clean. Differentiation cannot be watched as closely, nor is it as even as with individual sections, for sometimes a polka dot appearance results.

Celloidin sections that do not lie flat make unsatisfactory microscopic preparations as they do not differentiate evenly. They can, however, be straightened by floating them onto slides and immersing them briefly in absolute alcohol to which a few drops of chloroform has been added. These sections are transferred to slides coated with synthetic albumin, and then treated with collodion as described.

Some of the Difficulties Encountered in Celloidin Technic

1. Time is probably the greatest drawback of the celloidin technic since hastening the evaporation of the ether-alcohol

combination from the embedded material often causes bubbles, making it difficult to section the block. However, if carefully watched, an embedded specimen may be hardened more rapidly by vacuum or by application of low heat until bubbles begin to form. The surface must be kept soft so that the bubbles are allowed to work through to the surface.

2. Staining of individual sections also presents a time problem unless one resorts to the strainer method, staining many sections and picking out the best for mounting.

3. Embedded material sometimes becomes too hard before blocking. If this occurs, an open jar of ether-alcohol placed for a few hours in the belljar with the *covered* dishes of embedded eyes will soften the celloidin.

4. Blocks for sectioning should not be left in cedar wood oil for more than 1 or 2 weeks or they become too hard and are difficult to section.

5. Celloidin sections for future use will keep their shape and stain more easily if floated onto a strip of filter paper and made into packages before storing in 80 percent alcohol. Identification is made easy if the necessary data are written at the outer end of the filter paper with India ink and covered with Duco.

Sections stored for very long periods tend to become acidified and must be neutralized before staining.

H & E Stains for Celloidin Sections

Sections to be stained are held in 80% alcohol.

1. Place sections in 95% alcohol to remove cedar wood oil.
2. Float into water for several minutes.
3. Stain in Harris hematoxylin for 10 minutes.
4. Wash in water.
5. Differentiate in 1% acid alcohol (1% HCL in 80% alcohol) until background is clear or slightly gray.
6. Two changes of 95% alcohol to complete differentiation and clear celloidin.
7. Blue in tap or ammonia water for 10 minutes.
8. Wash in distilled water.
9. Counterstain in eosin (1/5% in 80% alcohol) for a few seconds.
10. Clear in 2 changes of 95% alcohol.
11. Float in Carbol-xylol (1 part Phenol fused crystals in 3 parts xylol). This completes the dehydration without shrinking sections. Sections should be mounted on slide from Carbol-xylol and rinsed gently but thoroughly with xylol before cover slipping.

A REVIEW OF RECENT ADVANCES IN HISTOLOGIC TECHNICS

MARY FRANCES GRIDLEY, MT (ASCP)

Many technologists engaged in the preparation of histologic slides seem to avoid special stains whenever possible, primarily because they regard the technics involved as time-consuming. Many of the recent stains may be done in a short time and the stock solutions required are relatively stable and may be used over and over again. There is a keen sense of accomplishment in the successful preparation of a stain designed to show a specific tissue component of cell product.

Fixation—The success of any stain is dependent upon well-fixed tissue. There are many good fixatives, but not all of them are appropriate for all special staining technics. When possible, it is well to fix material in several different solutions, namely, Zenker-formal, 10 per cent formalin, Bouin's, absolute alcohol and/or Carnoy's solution. With blocks fixed in these four solutions almost any stain is possible. When multiple fixation is not feasible, slides may have to be pretreated for special technics with dichromate, picric acid, or mercuric chloride solutions. For example, slides pretreated with Bouin's solution give much brighter Masson stains than untreated slides.

Dr. Lillie[1] has found that the addition of 2 per cent calcium acetate to 10 per cent formalin provides an excellent fixative and also a very good medium in which to store gross tissue. The staining quality of slides fixed in this solution is comparable to that of those fixed in buffered formalin.

Buchsbaum,[2] in 1948, using microscopy and individual cells from tissue cultures, was able to observe the changes which took place in the structures of the living cell when subjected to various fixatives, dehydrants, and clearing agents. The fixatives used in this experiment were absolute alcohol, Bouin's solution, 10 per cent formalin adjusted to pH 3.7, formalin adjusted to pH 8, Zenker-formal solution, and Zenker-formal-osmic acid solution. The last named yielded preparations most closely resembling the living cell when observed with the phase microscope, but the staining quality was somewhat impaired for observation under the direct light microscope. Zenker-formal and the 10 per cent formalin solutions gave better results than absolute alcohol, Carnoy's solution, and Bouin's fixative. The dehydrating and clearing agents had little effect after fixation.

Decalcification—Modification and improvement of decalcification methods continue to be published by many workers. Lucas[3] presents some observations and the electrolysis method, while Rosen and Friedland[4] point out that cancellous bone is decalcified as rapidly without electrolysis as with it. The latter use formic acid-hydrochloric acid mixtures at 32 to 35°C. or 37°C.

Birge and Imhoff[5] recommend disodium-dihydrogen versenate in saturated aqueous solutions for decalcification. They state that this method does not interfere with the staining affinity of the bone marrow cells. Kosbash and Leavitt[6] have noted minimal damaging action on cellular structure after decalcification in 5 to 10 per cent aqueous trifluoroacetic acid. This method is very rapid and staining properties are said to be excellent.

Embedding—Two technics which have been evolved in the past few years have facilitated the work of the technologist and are worth mention here. Bush and Hewitt[7] have introduced a technic for frozen sections using dry ice and a strip of gelatin which has been previously impregnated with dye. The dyed strip is placed on the block, frozen into position, and the section cut. The section adheres to the strip, absorbs the dye, and is then mounted on a slide. Undistorted thin sections can be made from very fragile tissues.

The carbowax technic is gaining in popularity and is proving to be of value in many laboratories. Wade,[8] in 1952, gave some very helpful notes on the use of this medium. He states that sections prepared by this method are appreciably better than paraffin sections when the acid-fast stains are used with old lepromatous lesions. Since the carbowax technic does not require the use of dehydrant and clearing agents, fats and lipoids are preserved and may be stained by any of the methods used for these substances. The sections may be mounted and stained directly on the slide, thus obviating the handling of discrete sections.

Fat Stains—Fats are stained by a group of oil-soluble dyes. Sudan II stains fat yellow; Sudan III, yellow to pale orange; Sudan IV, orange to red; Oil red O, a bright clear red; Sudan black B, blue to blue-black. Osmic acid was used by Marchi[9] in 1884 to demonstrate fat and fatty degeneration of the myelin sheath. This technic has been revised many times, most recently by Mara and Yoss,[10] who have shortened the time from days to hours. Daddi,[11] in 1896, reported the use of Sudan III in staining fat in tissue. This technic is still in use, often in its original form. Acetone and 70 per cent alcohol have been used as solvents for the dyes, and though they are effective as solvents, evaporation is so rapid that confusing deposits of precipitate are left on the sections. In 1951, Chiffelle and Putt,[12] advocated the use of propylene and/or ethylene glycol, which do not leave precipitates, as solvents for Sudan IV and Sudan black B.

Elastic Tissue Stains—A stain for elastic tissue fibers was reported in 1891 by Taenzer and Unna[13] who employed orcein. Their technic could be completed in from 24 to 48 hours. Weigert,[14] in 1899, used resorcin-fuchsin solution for his stain and cut the time considerably. These two stains were used for

many years, but in 1951 Gomori[15] published a new technic employing an aldehyde-fuchsin solution. This technic may be completed in from 20 to 30 minutes. In addition to staining elastic fibers, aldehyde-fuchsin is an excellent stain for the beta cells of the pancreas and certain types of mucin. Scott[16] has reported using this technic and counterstaining with phloxine and fast green FCF for the beta cells in pancreatic islands.

Reticulum Stains—Bielschowsky,[17] in 1905, published a method of silver nitrate impregnation for reticulum fibers. There have been many modifications of his stain through the years, including those of Foot,[18] Perdrau,[19] Wilder,[20] and others. The variations were usually in the processes of sensitization or reduction. All modifications used the same oxidation process of potassium permanganate and oxalic acid. This treatment often caused the section to float off the slide. In 1951 I published a new modification[21] of the silver impregnation method, which employs a 0.5 per cent periodic acid solution for oxidation. The particular advantage of this method is that several slides may be stained at one time in a single Coplin jar.

Collagen and Muscle Stains—The differentiation of collagen and muscle has proved of value to the pathologist since 1889 when von Gieson[22] found that picric acid combined with acid fuchsin provided a preparation in which muscle was stained yellow and collagen bright red. In the years that followed, Heidenhain,[23] Mallory,[24] Masson,[25] and others devised various methods which became known as triple or trichrome stains. Nuclei were stained with iron hematoxylin, and then a series of dyes, mordants, and differentiating solution was used. Recently the trend has been toward a one-step trichrome stain which combines all of the dyes and mordants in a single solution. Gomori[26] published such a trichrome stain that calls for chromotrope 2R and light green. Collagen is stained bright green; muscle, red to purple. Chromotrope 2R also demonstrates the striations in muscle fibers.

Mucin Stains—Mayer,[27] in 1896, stained mucin with a solution of carmine dissolved in an aqueous solution of aluminum chloride. McManus,[28] and later Hotchkiss and McManus[29] found that the leucofuchsin solution of Schiff, after oxidation of the sections with periodic acid, would stain both mucin and glycogen. To prove the presence of glycogen, duplicate slides are stained simultaneously, one untreated, the other subjected to diastase before staining. Periodic acid-Schiff reactions may be counterstained with contrasting dyes, hematoxylin, picric acid, metanil yellow, or others as desired.

Iron Reactions—Comparative studies have been made of the iron reactions of Perl prussian blue, Turnbull blue, and Gomori.

The Gomori[30] technic is much simpler than the others; its specificity is comparable to theirs.

Fungus Stains—Several authors have recognized that most fungi will stain with the periodic acid-Schiff reaction. At one time we used the Bauer[31] technic, but changed to the periodic acid-Schiff reaction of Hotchkiss and McManus since it was brighter. Because many tissue elements were stained by this technic, it was rather difficult to locate small groups of spore and mycelia. In 1951, Kligman, Mescon, and DeLamater,[32] reported the use of the periodic acid-Schiff reaction with a light green counterstain. This facilitates the location and identification of fungi.

Cryptococci have a mucoid capsule which can be demonstrated by Mayer's mucicarmine stain, periodic acid-Schiff reaction, and by the technic for acid mucopolysaccharide of Rinehart and Abul-Haj.[33]

It is the purpose of these brief descriptions to encourage you to try some of these technics in your own laboratories. Do not be afraid to make up your own modifications of stains. If you do not have one of the dyes called for, try a substitute, keeping in mind that the basic dyes are nuclear stains and the acid dyes are cytoplasmic stains. The field of special stains is wide open and there are many problems still unsolved. Put your ideas into practice, prove them right, then tell your co-workers about them through your journal.

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WHICH KIND OF RECRUITER ARE YOU?

RUTH DRUMMOND
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Mary Smith is out recruiting for medical technology. She is carrying her share of the responsibility that belongs to all medical technologists. She happens to have a Bachelor of Science degree, plus her medical technology training, and is certified by the Board of Registry. She has very definite ideas about the relative merits of two years of college and a college degree, as a prerequisite to technical training.

How does she handle her recruitment talks?

Does she say: "Now look, boys and girls, I know the Registry requires only two years of college before the technical training, but you'll get a lot farther if you have a degree. I know, because I have a degree and I have certainly gone a long way ahead of my friends who have only two years of college. Now I think you should have a degree, so just forget about what the Board of Registry says, and concentrate on getting a degree."

Or does she say: "Now the Board of Registry requires two years of college, during which time you will take certain science courses, before you go on to your laboratory training. There are many, many medical technologists who are doing a fine job and serving the profession well, with these qualifications. They may not have had the money to get a college degree, or they may not have had the time to spend, or perhaps they just did not want to go that far. The Board of Registry believes that these minimum requirements are sufficient as a prerequisite to training in an Approved School of Medical Technology, and so does the Council on Medical Education and Hospitals of the American Medical Association. You will get science and other courses that will help you to understand the training you will have in the medical laboratory. There is such a great need for medical technologists, and with those three years, the two years of college and one of laboratory training, you can go out and be a credit to the profession. After you get out of training and on the job, you will keep on learning, and this continued learning will never cease.

"It just happens that I have a college degree. I think I am a better medical technologist because of that, but I found it possible to get a degree and have never been sorry. My desire to learn more and more was heightened by having had a chance to go to college for four years. This is true in many other professions. Of course, you can all think of a number of successful people who have had no college, but don't forget that those people never stopped studying and learning. On the other hand, you may

know of someone who has been stopped in his climb to the top of his profession because he did not have a college degree. In medical technology, as in these other fields, it is more or less a personal decision for you to make, on the basis of your finances, or desires, because you *can* get a job in this field without a college degree. It's up to you to decide whether you want to go on to get a degree while you're about it. But whatever you do, get the best kind of training you can, whether you have had two years of college or a degree."

And then what does Mary Smith say about the specialized fields in medical laboratory work? Does she mention them? Or does she say this: "I have been talking about medical technology, training in all phases of medical laboratory work. I know that the little booklet I gave you mentions special training in certain branches of laboratory work, but you take my good advice and get the general training; that's what counts in getting a job. Oh, there are a few bacteriologists and chemists and histologic technicians, but I wouldn't give a thought to that kind of training; we want medical technologists wtih general training."

Or does she say, instead: "I have been talking about medical technology—training in all phases of medical laboratory work. There are many more of these laboratory workers than any other kind, but there is a place for specialized training also, and you should know about that kind of work, and what training you will need.

"Maybe you do not have the money to go to college and then into an Approved School of Medical Technology, let alone get a degree. Maybe you have always been especially adept at working with your hands, and like to work at jobs that call for delicate handwork. If so, you may be interested in histologic technic, which is work concerned with the tissues of the body. You will cut paper-thin slices of tissue, mount them on slides and stain them so that the pathologist can study them under a microscope. You will learn this in the general course in medical technology, also, but when you specialize in histologic technic you study it intensively for at least a year. You can do this work without any college background, but some college training, especially chemistry, will be a great help to you, and if you really want to go far in this field, you will do well to have as much college science as possible before you start training.

"Then there are bacteriologists and chemists, who may not do other kinds of work in the medical laboratory, but who become specialists in their fields and often limit their work to those specialties. They must have a Bachelor of Science degree in their specialty and at least a year of specialized training in a medical laboratory, if they want to become certified in these

fields by the Board of Registry. There are some who have gone still further, and have Master's or Doctorate degrees in their specialties.

"There are some disadvantages to getting only specialized training in one of the fields just mentioned. As I said before, the great need is for laboratory workers who are trained in *all* phases of the work, so that they can fit into any medical laboratory job. Therefore, if you limit your training to one field, you limit your opportunities for jobs. For instance, you may hear of a job in a small laboratory where you would have to do anything the doctors called for in the way of laboratory tests. With limited training you would be out of luck, because you could do only histology or bacteriology or chemistry. So you must weigh these things carefully before making any decision about whether you want to take the general training which fits you to do all kinds of work in the medical laboratory, or only the limited kind of training which would limit your opportunities for jobs. I've been in laboratory work for a long time, and I really believe your best bet is to get the general training, and then if you get interested in a certain phase of laboratory work after you have been at work for awhile, you can think about specializing."

Which kind of a recruiter are you? Do you let your personal opinions stand in the way of giving young people broad information about the complete picture of opportunities in medical laboratory work? Which kind of a recruiter will serve the profession of medical technology best? What do the vocational guidance counselors say is the best way to satisfy young people who are seeking information about any field of work?

What *is* recruiting? The dictionary says it means to replenish. Is there a need to replenish with *only* degree medical technologists; or with *only* medical technologists trained in all phases of medical laboratory work? It is fine to have as much education as possible, but when the need for medical technologists is so desperate, shouldn't we try to get as many trained by generally accepted standards as we possibly can? Does not that imply that we must try to replenish with two-year college people; and that we also consider the persons who have had specialized, though possibly limited training? Recruitment—replenishment—whatever we call it, let's do it! But let's tell the young people about *all* of the opportunities in the profession.

WONDERS OF THE CELL*

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The cell is to biology and medicine what the atom is to chemistry and physics. All day, every day, medical technologists work with cells in pathology, parasitology, hematology and histology, and even when they perform chemical or metabolic tests they are studying the chemistry and metabolism of cells and their products, yet all too frequently they fail to think quantitatively about the detailed characteristics of cells. In order to think in quantitative terms about the myriad functions and capabilities of cells—both normal and pathologic—it is necessary to have or develop an informed awareness of their structure, function, chemical composition, metabolism, growth and development, and of the integrated and coordinated relationships of all these diversified factors. When integration and coordination cease, the cell not only dies, but also dissolves and autolyzes its own structure completely by means of specific enzymes contained within it. The cancer cell and the leukemic cell are characterized by a deranged coordination between the different phases of growth as compared to the corresponding normal cell.

Since 1936 when we began culturing, or growing, human marrow and blood cells outside of the body, we have had to think about cells in a much more detailed and quantitative way than formerly. Thinking in quantitative terms has added so much to my interest in the cell that it occurred to me it might add to your interest also. You are all familiar with the major structures and properties of cells, and know something of their chemical composition, size, number, and their growth process of multiplication, differentiation and death, but have you ever considered how all these properties are integrated and coordinated, or what is known of the function of each structure within the cell?

The typical cell has a nucleus, surrounded by a nuclear membrane. The nucleus consists of a nuclear sap or fluid in which are present, during the resting stage, the intact, uncoiled chromosomes. In the nucleus of cells capable of mitotic division one or more nucleoli are visible. On the 24 pairs of chromosomes contained in the cells of man there are strung, like beads, the 50,000 to 100,000 genes that bring to every cell in the body all that was inherited from the father and mother and all their an-

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cestors back to the first living, single cell. These chromosomes consist chiefly of desoxyribose nucleoproteins, and it is the desoxyribose nucleic acid portion of these proteins that accounts for the characteristic staining properties of the nuclei, giving them their affinity for the purple dye, azur, in Wright's stain. The nucleolus, however, consists chiefly of ribose nucleoprotein, and stains a clear blue with Wright's stain, as does also the background of the cytoplasm of most cells, which also is rich in ribose nucleoprotein but contains no desoxyribose nucleoprotein. One or the other or both of these types of nucleoproteins have been found in every living cell, so far investigated, at some stage in its development; even viruses consist largely of such nucleoproteins. Desoxyribose nucleoproteins increase in amount only when new cells are formed, and by measuring the rate at which radioactive phosphorus is incorporated into desoxyribose nucleic acid it has been possible to measure the rate of new cell formation. It has been possible to show, by such a tracer study, that muscle and brain cells do not increase in number in adults, and that the survival time of the granulocytic series of leukocytes is of the order of three to eight days, whereas the lymphocytic series of cells live much longer, possibly 30 to 100 days.

Each gene on every chromosome has the property of reduplicating itself and of producing some one enzyme or protein molecule. Because of the longitudinal splitting of the chromosomes, the process of mitotic division insures that every cell receives its full quota of genes and chromosomes—one of each pair coming from the father and one from the mother. The single exception to this is the sperm and ovum in which the number of chromosomes is reduced by a process called meiosis, so that when these cells unite, the number of chromosomes in the fertilized ovum is again 48 and not twice that.

Could anything be more remarkable than that the wisdom derived from the trial-and-error experiments of evolution over the ages since life began, including everything in heredity that came from your father and all his ancestors, was preserved and transmitted as a library of patterns all contained in the chromosomes in the head of a single sperm, the volume of which is far less than that of one erythrocyte? There is, of course, provision for shuffling and reshuffling of the genes to such an extent that vast numbers of different combinations can be tested out in the competition of life, and only the best be preserved. There are also provisions for muations or inheritable changes in individual genes, and for rearrangement of the position of these genes on the chromosomes, which, while usually resulting in an inferior product that is eliminated, at

rare intervals leads to the development of an individual more successful in the competition for survival and a mate, and so is preserved in the slow evolutionary development of a new species.

The ribose nucleoproteins of the nucleolus and cytoplasm turn over much more rapidly than the desoxyribose nucleoprotein of the nucleus, and seem to be essential for the production of the major portion of the proteins of the body. They are not situated solely at random in the fluid portion of the cytoplasm but are localized in mitochondria, in the microscopically visible granules and in invisible, finer particles, still complex in composition, called microsomes; these are all suspended in the fluid plasmasol or imbedded in a matrix of a loosely woven brush-heap of protein fibrils and plasmagel that gives structure to cytoplasm and provides enormous surface area at which chemical reactions can occur.

The typical cell consists of 70 to 80 per cent water, but much of this is bound to these colloidal proteins and to the phospholipids and so is not free water available for solution of electrolytes. The protein in solution is in a hydrated colloidal state that can transform from gel to liquid form with slight changes in water content, temperature or electrolyte balance, much as a gelatin-gel can change from solid to liquid with similar slight changes in temperature, water, or electrolyte content. It is thought that such a process as gelation and contraction pushes out the pseudopodia and accounts for the motility of cells and for the movements of cilia, the sperm tail, the complex but organized movements of the chromosomes and the squeezing asunder of the cytoplasm that occurs in mitotic division.

The intracellular water level is usually maintained within the critical limits necessary for life, notwithstanding great variations in fluid and salt intake or the excessive losses that may occur with vomiting, diarrhea, or the perspiration of heat or fever. The organisms living in the sea and highly saline lakes, or in fresh water lakes and rivers have, from a chemical standpoint and that of their energy requirements, a still more difficult problem; yet even the cells of these organisms are able to maintain a water and electrolyte composition similar to that of the primeval seas where life probably began, which were much more dilute than present-day seas.

The visible structures within the cytoplasm of cells are not as a rule simple, single chemical compounds. Vacuoles may contain free water and nutrients, oil or phospholipid storage droplets, or the remnants of partially digested, phagocytosed particulate matter from the environment. Others may contain

segregated waste products of cell metabolism or abnormal, denatured proteins. Some vacuoles serve as the digestive and excretory systems of the single cell. The resemblances between the highly phagocytic cells of the granulocytic, monocytic and histiocytic series and the ordinary pond amebas are striking indeed, when one considers how far separated they are in the evolutionary scale of life.

Mitochondria are rod-shaped, lipid-rich structures, visible with the phase microscope or with certain stains, that are present in all young cells. They have been shown to contain ribose nucleoprotein and many different enzymes, to stain with Janus green in supravital preparations but to be dissolved by the methyl alcohol of Wright's stain, leaving slight, clear spaces in the cytoplasm. It is thought that they represent major sites of protein synthesis and energy metabolism, and that the grouping of enzymes in these organized structures greatly increases their efficiency as compared to that of free enzymes in colloidal solution. Mitochondria can be seen clearly in unstained, moist-coverslip preparations of almost all living cells, using the phase microscope, as they flow hither and yon in the streaming plasmasol.

The visible granules in cells are of great variety and complexity and differ markedly in the different cells of the body. The different staining characteristics of the four major types of visible granules in leukocytes as well as their wide differences in size and shape illustrate this diversity. Yet all three of the specific types of granules (i.e., neutrophilic, eosinophilic and basophilic) are peroxidase positive, indicating the presence of a common enzyme. All give positive tests for lipid and all undergo striking changes in shape, size and tinctorial affinities as they age or under the influence of disease. The granules of many body cells are obviously secretions en route to secretory ducts or the blood stream. The varied character of the secretions of cells—from the hydrochloric acid poured into the stomach, the alkaline secretion of the pancreas to the hormones of the endocrine glands—makes one marvel at the diversity of products and the chemical prowess of these intracellular chemical laboratories. Most cells make cholesterol from acetate, and the adrenal glands make cortisone from cholesterol in a twinkling of an eye. Either of these chemical achievements would, today, bring fame and fortune to the chemist who, with all the equipment of the great research laboratories of the world, could duplicate them.

The membranes of cell walls are no less remarkable and diverse in their characteristics. The mighty redwoods and all the lumber of commerce consist mainly of plant cell walls. The

delicate membranes of amebas and the phagocytic cells of the animal body must be able to separate high concentrations of potassium inside the cell and high concentrations of sodium outside the cell—an accomplishment no man-made membrane can perform—yet be able to form pseudopodia that can sweep around and engulf a bacterium with a diameter 1,000,000 times that of sodium or potassium atoms. The living membrane of the capillary wall permits leukocytes to wander back and forth through it freely but holds back erythrocytes and plasma proteins. The membranes of the cells of the respiratory tract from bronchiolae to nasal mucosa have cilia that maintain a constant current in the mucin secreted by neighboring cells and always in the right direction to carry particulate matter out of the respiratory tract. The undulant membranes of trichomonads and the appendages of many unicellular parasites serve as a means of rapid, directed locomotion.

All activities of cells require energy, which is derived largely from oxidation of glucose, amino acids and acetate, to which all ingested carbohydrates, proteins and fats are ultimately converted before entering the general metabolic pool of the extracellular fluid, from which each cell withdraws its needed fuel supplies and into which it discards the excess carbon dioxide, water and nitrogenous wastes. To oxidize these substances outside the body requires a burning heat to start the reaction, and the maintenance of burning heat during the reaction. Living cells accomplish this at 37° C. and remain at that temperature. They do it by stages, through the action of the enzymes and coenzymes of the Krebs cycle. Most of the vitamins and trace elements, or compounds that the body cannot manufacture, have now been proved to be essential groups in enzymes or coenzymes. If these essential groups are present, the—to most chemists—difficult part of the synthesis of the specific protein complex that will speed up one and only one specific chemical reaction is readily accomplished by almost any living cell. The amounts of these vitamins and trace elements needed to make the difference between life and death for the cell are unbelievably small. One microgram per day of vitamin B_{12}, containing only one atom of cobalt per molecule or 4 per cent by weight, will make the difference between life and death for 70 kilograms of pernicious anemia patient. That is one part of vitamin B_{12} per day in 70,000,000,000 (7×10^{10}) parts of pernicious anemia man.

Remarkable as the various structures of the cell are, the essence of life seems to lie in none of them, but rather in the optically clear, colloidal solution of proteins, enzymes and other compounds. E. B. Harvey has centrifuged fertilized sea-urchin egg cells *(Arbacia punctulata)* in the ultracentrifuge for long pe-

riods of time at centrifugal forces up to 950,000 times the force of gravity. The nucleus and lipid droplets rise to the top of the egg and the granules sediment to the bottom of the cell, which becomes greatly elongated. If the clear, middle zone of such a cell is then cut apart from the rest under the dissecting microscope it will still divide and develop for a time. The human erythrocyte contains no nucleus, but lives 120 days. The reticulocyte with no nucleus can synthesize hemoglobin. The chromosome with its nucleoproteins removed maintains its form. Therefore, it appears that the enzymes, with their molecules usually consisting of a large specific protein as the major part and a relatively small specifically active coenzyme group—comparable to the globin and heme parts of hemoglobin—constitute the real basis of life. This would account for the extreme sensitivity of cells to alterations in pH, osmotic pressure, colloid osmotic pressure, and the presence of surface-active agents (detergents and soaps), traces of heavy metals, and temperatures above 42° C, for all these are protein denaturants. On the other hand, cells withstand pressure, centrifugal forces and low temperatures above freezing well. If cells are chilled rapidly enough to prevent disruption by ice crystals and dried from the frozen state and then rewarmed and rehydrated rapidly enough, they may survive, indicating again that the essence of life lies in the chemical integrity of the cell proteins.

How can proteins and enzymes accomplish so many and such varied functions? We talk glibly of albumins, globulins, protamines and of conjugated proteins—such as hemoglobin and most enzymes—but we often forget that molecular size, even of such relatively large molecules as proteins, is of an entirely different order of magnitude from cell size. For example, the typical adult erythrocyte of man contains 250,000,000 hemoglobin molecules of molecular weight 68,000, yet hemoglobin constitutes but one-third the weight of the erythrocyte. Still more important is the infinite variety of proteins possible. Even relatively small proteins like albumin and the globin portion of hemoglobin, with molecular weights of 60,000 to 70,000, release on hydrolysis about 600 alpha amino acid residues of over 20 different varieties. It has been calculated that the different possible linear arrangements of these would exceed the number of electrons in the known universe. The possibilities are enormously increased by the presence of branching and prosthetic groups in most known proteins, and by any increase in molecular weight; some nucleoproteins and virus proteins have molecular weights of over 1,000,000. No wonder each species can have its own specific hemoglobin and that a specific protein antibody can be produced by cells that will react specifically with one and only one of

many thousands of known antigens. Furthermore, human cells can manufacture all but nine or ten of these amino acid building stones.

The transportation system of the blood, which brings oxygen, glucose and amino acids to the cells, is so remarkably efficient that only about a three-minute supply of oxygen, an eighteen-minute supply of glucose and a thirty-minute supply of amino acids are present in the blood stream at any one instant of time. An amount equivalent to all the urea present in the blood is excreted by the kidneys every 75 to 100 minutes, and a volume equivalent to all excess carbon dioxide in the blood is eliminated by the lungs in less than one minute.

The shapes of cells are remarkably adapted to their functions. The erythrocyte presents the optimum surface compatible with rapid exchange of oxygen and carbon dioxide, which will still permit its passage through capillaries. The streamlined sperm is built for speedy locomotion. The neuron with its axon—which may be a hundred thousand times as long as the cell diameter, yet dies if cut off from the cell and regenerates from the cell distally—is shaped and functions like a telegraph wire.

The integration of the activities of cells remote from each other is regulated by nervous impulses, by the chemical messengers, the hormones, and by excess or deficiency of nutrients and waste products, but the regulation of the various phases of growth is far less well understood. Lack of integration of the phases of growth is the outstanding characteristic of the cancer cell as compared to the normal cell, and aging and cell degeneration are also associated with imbalance in the phases of cell growth. The phases of cell growth include increase in cell number, increase in cell size, cell differentiation, and cell death and autolysis. It is obvious that these processes are integrated in normal cells. If they were not, no fertilized ovum by successive cell divisions would ever develop into a normal human infant, and cells would get bigger and bigger if there were no cell division, and they would get smaller and smaller if there were cell division without increase in size. All would be fertilized ova if there were no differentiation. All would live forever if there were no cell death, and we would have to carry about many times our weight of dead cells were there no cell autolysis.

Differentiation is the least understood of these processes. The first few cell divisions of the fertilized ovum lead to formation of cells still able to form a complete human being, as evidenced by the occurence of identical twins or even quadruplets. The cells that will form the sperms and ova of the next generation are early segregated, and from these alone comes the continuity

of the apparent everlasting life of the main evolutionary stream. All other cells, although receiving like chromosomes and presumably all genes, become specialized to a greater or lesser degree. This specialization involves loss of multipotency and manifestation of only certain of the capacities of the unspecialized cell. There is a price for specialization of cells just as there is for specialization in human occupations. Chemical compounds called organizers produced by cells during embryonic development influence the growth of adjacent cells. An eye bud from the nervous system of a developing salamander transplanted under the skin of the back will cause skin cells there to infold and form a lens and cornea for an eye where no eye ever was or was meant to be. Such phenomena are not well understood and much remains to be learned about normal and abnormal growth processes and the factors affecting them.

A little thinking about the equilibrium state of a differentiating series of cells in the adult, such as skin cells or the erythrocytic and granulocytic series of blood cells, will show that there has to be a mathematical relationship between the proportions of the different stages and their life spans, and that for equilibrium to exist there must be one cell division for each cell death. It should be equally obvious that when one cell divides, of the two resulting cells, one must remain immature and capable of division again, while the other must differentiate on into the adult form and die. What makes the difference between the cell that stays immature and the cell that grows up and dies? No one knows. Both presumably have the same genes and chromosomes. Is it a difference in environment, or a single granule or structure that goes only into one of the cells? Does each granule divide when a cell divides, or how does it again acquire its full quota of granules?

It has been well established that the human erythrocyte lives 120 days; therefore, the reticulocyte must live 1.5 per cent of 120 days, or 1.8 days, since reticulocytes constitute, on the average, 1.5 per cent of circulating erythrocytes at equilibrium in the adult. Similarly, the proportions of the various nucleated erythrocytes in the bone marrow—rubriblasts, prorubricytes, rubricytes and metarubricytes—must be proportional to their life spans. The total number of nucleated erythrocytes in the bone marrow should be $\frac{1.5}{120}$ or 0.0125 times the number of erythrocytes in the blood stream at any one instant of time, which is about 25×10^{12}; so, there should be a total of about 3×10^{11} nucleated erythrocytes in the marrow at any one time. Similarly, there must be $\frac{25 \times 10^{12}}{120}$ or 2×10^{11} cell divisions in the

erythrocytic series of cells in the marrow per day, or 1.5 cell divisions per day per nucleated erythrocyte in the marrow, which is one division every 18 hours. These divisions occur only in the more immature cells of the series, so the actual intermitotic interval is probably much shorter than this.

We have chosen the human granulocytic series of cells, studied in tissue cultures, for an attack on these problems of gaining better understanding of cell growth and differentiation, because these cells show easily recognizable stages of differentiation, have leukemic (cancer-like) counterparts, will grow in suspension so that adequate controls are possible, and because any quantitative study can be made on cultures of these cells that can be made on whole blood. In the 16 years since this work was started, we have learned how to separate leukocytes from erythrocytes, how to count mitoses arrested by colchicine, what the size of cells of the granulocytic and lymphocytic series is, how to measure the rate of new cell formation by studies of the uptake of radioactive phosphorus into desoxyribose nucleic acid, and several ways of measuring whether a cell is alive or dead, none of which is completely satisfactory. We have noted that the nucleoli of leukemic cells are usually larger than the nucleoli of the corresponding normal cell. We have begun to study the chemistry and turnover rate of the phosphorus compounds of these cells, but these are only the tools for use in attacking the major problems of growth.

From these known facts about cells several practical suggestions for your everyday work may be deduced. Whenever you handle blood or marrow, which are suspensions of living cells, stopper the container quickly so that toxic dusts do not fall into it. Cool the specimen rapidly so that acid metabolic wastes do not change its pH. Never expose it to ammonia or acid fumes for the same reason. Be sure all surface-active soaps and detergents have been removed from slides and containers; oil from a finger print has a similar surface-active lysing effect. Make blood and marrow smears thin to insure rapid drying so that osmotic changes, which distort cell morphology, are minimized. Use a buffer of pH 6.4 with Wright's stain so that the optimum pH of staining is maintained. Study cells on the smear only in areas where erythrocytes do not touch each other, for here only are cells undistorted. Count all disintegrated cells in a differential, for these give an indication of the rate of cell death. Above all, observe—that is, think while you look and measure—for there is much to see and thereby to be learned if we but look for that which differs from the familiar and the known.

In summary, can you imagine a mobile, self-reproducing factory, which selects its own raw materials, manufactures not one

but many products, rebuilds and repairs itself constantly, provides its own power supply, has automatic local and remote controls, transports its fuels, products and waste products with great efficiency, which may be versatile or specialized, but is integrated by efficient communication systems with the needs of the community, and always provides reserves for emergencies? Such a factory is the cell. The ovum and sperm, still more wonderful, discard their mistakes and try ever new combinations until they find a better way.

It is my hope that this discussion will lead you to read more about cells, will make your daily work more interesting, will lead you to treat cells tenderly and regard them with humility, and will help you to think while you look and measure—in other words, to observe. There is no reason why a technologist could not make an observation as important as Laveran's discovery of the malaria parasite (a cell within a cell), or note another gene-transmitted anomaly of cells—such as those occurring in hereditary spherocytosis, sicklemia or hereditary leptocytosis—or even be the first to observe some important, regularly recurring difference between leukemic and nonleukemic cells that would give the clue to the common denominator in cancer.

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BLOOD IMMUNOLOGY: A Survey of Recent Literature

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When the technologist reads of recent findings in the field of Blood Immunology, he or she is apt to feel that it will soon be impossible to transfuse patients more than once; or should multiple transfusion be absolutely necessary, that it could only be accomplished safely following quite lengthy cross-matching procedures. Fortunately this state of affairs has not yet come to pass, although certain rare cases do require specialized techniques in cross-matching if blood is to be transfused safely.

It is not the purpose of this article to go into detail in describing individual techniques, or even to discuss whether they should or should not be used. It is the province of the individual laboratories to decide which procedures or combinations of procedures should be used. It was thought, however, that a survey of recent literature with references to pertinent books and articles might be of interest and of some value, particularly to those technologists who have limited opportunity for study in any one field of Medical Technology. Even a glance at the many proposed new techniques and the really formidable array of blood groups now known would indicate that any technologist who does work in the field of blood immunology should know where to find references that deal with the subject.

First let us consider a few recent books. And please understand that this is by no means a complete list of books or articles, rather a few of those found useful and available at the time of writing.

Race and Sanger's "Blood Groups in Man"[1] contains in one volume much valuable information, especially on the blood groups less frequently mentioned, such as the MNS system, P, Lutheran, Kell, Lewis, Duffy and others. Until publication of this book in 1950 information on many of these groups was difficult to find and, indeed, almost unavailable unless one had access to a library with many different periodicals on file.

"Blood Transfusion in Clinical Medicine" by Mollison[2] is a very readable book. The technologist will find Chapters VI, VII and VIII on Blood Groups, Formation of Immune Iso-antibodies and Blood Grouping Techniques of special interest. The techniques presented are those used in England and differ in some respects from those in general use in the United States, but many tests of value in demonstrating the rarer antibodies are described. Also, there are some interesting figures presented on the "relative frequency of formation of different Rh antibodies

in pregnancy" (page 189) and the "relative antigenicity of some blood group factors" (page 200). These statistics are of great value when one is trying to decide which antibodies to test for when a limited amount of serum is available.

To those having an interest in the medico-legal aspect of blood grouping Andresen's "The Human Blood Groups"[3] contains much useful information. This is a short book (124 pages) and is well worth the time it takes to read it.

Your author has not had the opportunity of reading "Grouping, Typing and Banking of Blood" by Pollak,[4] but would like to direct your attention to a critical review of this work by Dr. I. Davidsohn on page 181 of the July, 1952, issue of the Technical Bulletin of the Registry of Medical Technologists. From this review it appears that the book contains a great deal of misinformation which would make it of little value to the technologist.

When a search of current periodicals for articles pertinent to a specified subject is made, the total is limited only by the time and number of periodicals available. It is difficult to keep up with even a few of the many journals published, though there are, of course, a few more apt to carry articles of value in any given field. It has been found that the Journal-Ease section of "Lab World" is a good source of titles that may be of interest. References are listed under general headings with title, author, periodical volume and page given. In addition many of the listings make note of the content of the article in question. With this information at hand, the author may be contacted for a reprint if the periodical is not available.

Just as a matter of reference a list of the Rh factors in both Wiener's and the Fisher-Race classifications will be given here, together with some of the other blood groups known at the present time.

Rh_o D	Hr_o d
rh′ C	hr′ c
rh″ E	hr″ e
Rh_o variants D^u	rh^w C^w
the MNSs[5] system	Lutheran or Lu^a
Kell or K	Kidd or Jk^a [8, 9]
Cellano or k[6]	Jay or Tj^a [10]
Duffy or Fy^a and Fy^b [7]	
Lewis or Le^a and Le^b	

Information on most of these groups may be found in Race and Sanger's "Blood Groups in Man" as has already been mentioned. More recent references have been noted in the bibliography.

The importance of recognizing the D^u factor in blood donors and in the husbands of rh negative women is apparent when you realize that D^u cells can provoke the production of anti-Rh_o (anti-D) antibodies of the incomplete or blocking type[11] just the same as Rh_o or D cells can. Special techniques are required to demonstrate D^u cells, usually sensitization of the cells with a known anti-D serum followed by an antiglobulin (Coombs') test on the washed sensitized cells. It is essential to know that the anti-D serium used in the sensitization step is free of other incomplete antibodies that could interfere with the certain identification of the cell as D^u. This point is brought out by Rosenfield and Vogel[12] in their article on "Weakly reacting Rh positive (D^u) bloods." It is noted that any antibody (such as Kell, Duffy, blocking or immune A and B, rh′, rh″, etc) which could give a positive indirect antiglobulin test might lead to a false conclusion with a cell that was in reality D^u negative but positive for another factor. More recently Chung and Bender[13] have advocated trypsin treatment of suspected D^u cells before the usual sensitization and antiglobulin procedure.

This is not the first use of trypsinized cells in conjunction with the antiglobulin test. In 1951 Unger[14] suggested using this technique to detect Rh_o antibodies in very low titer. Later this same author discussed the effect of trypsin on some of the blood factors other than Rh_o.[15, 16] He found that some factors (D,D^u, C,E,C^w,c,e,A,B,P,S,s,Le^a, Cellano,Lu^a,Jk^a) are made slightly more sensitive or are unaffected by the trypsinization of the cells; Kell is unaffected and still requires special techniques to demonstrate; Duffy (Fy^a) is apparently destroyed so that the cells no longer can be typed for this factor; and M and N are damaged to the extent that it is more difficult to demonstrate their presence.

And while on the subject of antiglobulin tests it would be well to note another article by Unger[17] in which he demonstrates that the excellence of results obtained in indirect antiglobulin procedures depends in a large part on the potency of the antiglobulin serum used.

Hulse[18] in 1951 called attention to the effect of heat on certain blood antigens. To quote: "Besides theoretical interest the results of this investigation have some bearing on practical blood grouping serology. The procedure of eluting cells in saline at 56° C. has been applied to the investigation of acquired hemolytic anemias to remove strong autoagglutinins and to remove antibodies from the surface of the cells of infants suffering from hemolytic disease of the newborn; it is then usual to check the Rh groups of the cells. The heating usually recommended is five minutes. The present investigations suggest that this period

should not be exceeded if Rh or Lewis typing is to be done (except for antigen c) and even then high titered antisera should be used if reliable results are to be obtained. The results also emphasize the need to avoid heating blood samples during transit and that . . . staff should be instructed not to place samples on or near radiators, etc." He goes on to say that antigens D,C,E,e, Le^a and Le^b were found to be heat labile, while A,B,M,N,c and H were confirmed as heat stable.

Mention of the possible use of dextran as a plasma expander makes it necessary for the technologist to have some knowledge of whether there would be any effect on blood banking procedures following its use. Roche, Dodelin and Bloom[19] have written that when the dextran used was hydrolyzed and fractionated so that the majority of molecular sizes were distributed in the physiologic range of the plasma proteins, there was no interference with the usual typing and crossmatching tests. This was found to be true even after as much as 3000 cc had been administered. However, when the dextran used was of a larger molecular size it caused clumping and rouleaux formation.

The use of polyvinylpyrrolidone (PVP) in detecting Rh_o antibodies is discussed by McNeil and Trentelman.[20] In other articles[21, 22] these same authors report favorably on the results of a simplified test using PVP as compared with the indirect antiglobulin procedure when used in Rh titrations.

In closing brief mention will be made of a few articles referring to prenatal checks for antibodies. The importance of checking Rh positive mothers and also recipients of transfusions for immunization to rh″ (E) is brought out by Malone and Dunsford.[23] The effect of Rh-positive pregnancy on Rh antibody titer is discussed by Dr. A. S. Wiener.[24] Dr. Wiener has also written on problems in the management of Erythroblastosis Fetalis.[25] In this latter article he gives details of five cases showing unusual serological findings. The last reference to be noted is one referring to congenital hemolytic disease due to A-B-O incompatibility which can be found in the 1951 Year Book of Pathology and Clinical Pathology.[26]

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REPORT OF A CASE OF TRICHOSTRONGYLUS SP. INFESTATION*†

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This report presents the history and findings in an individual suffering from an acute episode of furunculosis as well as from numerous parasites. In specimens submitted to Evanston Hospital's laboratories by this patient, there were found seven types of parasites, among them the ova of a Trichostrongylus worm of unknown species. Evidence of the presence of this parasite is seldom observed in the Chicago area. Because there are a number of foreign students enrolled at Northwestern University, such unusual medical problems occasionally come to the attention of the physicians at the University's Student Health Service.

Since trichostrongyle worms are rarely reported in this country, and their ova are frequently mistaken for hookworm ova, patients in whose intestinal tract the worm is found may be subjected to hazardous treatment before the ova of the parasite are recognized.

Case Report

Mrs. K. S., a 31-year-old Fulbright scholar of Teheran, Iran, while visiting Northwestern University for a few weeks during 1951, reported to the infirmary for examination of an axillary abscess. She was hospitalized for treatment of this condition. Her history revealed that she also was suffering from some bowel distress, fatigue, and nervousness. Her past history brought out the fact that the patient had had recurrent attacks of painless jaundice since the age of 13, perhaps ten times in all. Treatment for these illnesses had consisted of 5 to 10 days of bed rest on each occasion, plus a high protein, high carbohydrate diet, with no animal fat. She recalled having had dysentery at 18 years of age.

On questioning the patient regarding the environment in which she had lived before coming to this country, it was established that Teheran's water supply came from springs, but that no chlorine disinfectant was employed before the water was delivered to the mains. Occasionally citizens were advised to boil their water before drinking it. Vegetables, obtained from surrounding farms, were soaked in potassium permanganate solution 2 to 3 hours before use. The patient further stated that human feces is still a common fertilizer for the farms in this area.

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† Reprinted from the *Quarterly Bulletin*, Northwestern University Medical School Chicago, 1952, Vol. 26, No. 4, Page 321, Winter Quarter, with the permission of the authors. Original title "Report of a Case of Multiple Parasitosis Including Trichostrongylus sp. Infestation."

Physical examination disclosed that the young lady was a well-developed, well-nourished individual who was not acutely ill. There was a moderate scoliosis to the right and a slight kyphosis. There were no other remarkable findings with the exception of the furuncule which consisted of an egg-sized, red, fluctuant mass in the left axilla.

Laboratory and Clinical Examinations

Because of the history given by this patient it was decided that a complete laboratory work-up was indicated. The following data cover the pertinent findings in this case:

Hematology: Red blood count, 5,400,000 p. cu. mm., hemoglobin 14 grams per cent, white blood count 8,900 p. cu. mm. with 59 per cent neutrophiles, 5 per cent eosinophiles, and 26 per cent lymphocytes; *Biochemistry:* Thymol turbidity 2.9 units, bromsulfalein test showed 3 per cent retention in 45 minutes, alkaline phosphatase was 1.6 units, direct bilirubin was 0.09 mg.% in 1 second, total bilirubin was 0.98 mg.%, blood sugar 85 mg.%, fragility test of red cells showed hemolysis starting at 0.43 per cent NaCl and completed at 0.30 per cent NaCl; *Urinalysis:* Two urine specimens were normal; *X-ray Examination* of the chest and *Proctoscopic* examination revealed no abnormalities; *Bacteriology:* Examination of four stool specimens revealed no pathogens of the Salmonella or Shigella genera.

Parasitology

During the period from October 24, 1951 through December 17, 1951, 14 stools from this patient were examined. Tables I and II present the organisms and/or ova found during the course of these examinations. Figure 1 shows a microphotograph (x 800) of a typical ovum of Trichostrongylus sp. obtained from the stool of this patient. Note the larva folded upon itself within the shell. Since the patient was intensely interested in parasitology she

TABLE I

Protozoa Found During the Examination of Fourteen Stools from K. S., October to December, 1951

Name of Parasite	Trophozoites	Cysts
Chilomastix mesnili	Many Found	Many Found
Dientamoeba fragilis*	Many Found	
Endolimax nana	Many Found	Many Found
Iodamoeba butschlii	Many Found	Few Found
Trichomonas hominis*	Many Found	

* These species do not form cysts.

TABLE II

Evidence of Nematode Parasites Found During the Examination of Fourteen Stools from K. S., October to December, 1951

Name of Parasite	Adult	Larva	Ovum
Ascaris lumbricoides	Not Found	Not Found	Many Found
Trichostrongylus sp.	Not Found	Not Found	Few Found after Concentration

gave us excellent cooperation, and we were able to obtain the number of stools herewith reported.

All the parasites listed were seen on direct examination of wet mounts with the exception of the ova of Trichostrongylus sp. It was found necessary to employ acid ether and modified zinc sulphate concentration technics[1] before this form was seen. Formalin-ether sedimentation[1] was used to assist with the identification of the protozoa. Trichostrongyle ova were not demonstrated by this method. Permanent mounts of the stools were also prepared. These were stained by the Markey-Culbertson-Giordano hematoxylin method.[2] Cultures were made on all stools on Balamuth's medium.[3]

Treatment of this patient consisted of bed rest, hot fomentations, penicillin and chloromycetin for the abscess. A course of hexylresorcinol was prescribed for the nematode parasites. Repeat stool examinations two weeks after the hexylresorcinol had been stopped revealed the continued presence of both species of nematodes. A second course of hexylresorcinol was then administered. A recheck two weeks following the second course of the antihelminthic drug revealed no ascaroid ova. The other parasites persisted.

The Trichostrongyles (fig. 2) are small slender, bursate nematodes with unarmed heads, which live with their cephalic ends imbedded in the epithelium of the small intestines of (with two exceptions) herbivores.[4] The word "Trichostrongylus" is derived from the Greek "Trich = hair + strongylos, round".[5] This designation obviously refers to the shape of the adult animal. The following genera are included among the Trichostrongyles: Trichostrongylus, Ostertagia, Cooperia, Hyostrongylus, Ollulans, Haemonchus, Mecistocirrus, and Nematodirus.[4] The eggs, which are segmented and generically characteristic, are oval-elongated, hyaline-shelled, resembling those of hookworms except for their longer, narrower shape and more pointed ends (fig. 1). These eggs are usually discharged in the morula stage of embryonation[6] and under favorable conditions of moisture and temperature may hatch within 24 hours or may survive long

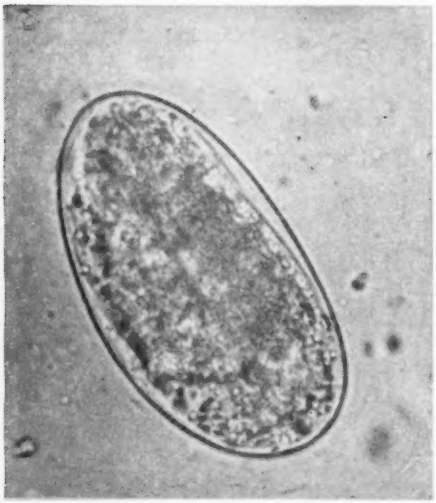

Fig. 1. A microphotograph of an ovum (x 800) of Trichostrongylus sp. from a stool specimen obtained from patient K. S.

Figure 2.

periods of drought and cold. The newly-hatched larvae are free-feeding. They moult twice to become third stage or infective larvae in a manner very similar to that seen in the hookworms. In some species the larvae appear to be able to penetrate the skin,[6] but usually infection follows ingestion. Development within the intestine occurs without migration.

Man apparently is accidentally infected from contacts with the normal hosts or their environment. The infective larval forms can remain alive in the soil of pastures for many months and can survive great desiccation. It is felt by most authorities[5,10] that infection in man is acquired by way of the mouth and not through the skin. The work of Stewart[7] supports these contentions. Stoll[8] has estimated that the several species of Trichostrongylus which are capable of infecting man constitute a worm burden to 5.5 million human beings, almost all of whom are found in Asia and the U S.S.R. Evander and Doyle[9] believe that the reason so few cases have been reported in America is due to the lack of knowledge regarding differentiation of the ova of these worms from those of hookworms. Maplestone,[10] in 1941, pointed out that the failure to differentiate hookworm ova from those of the trichostrongyle worms subjected patients to needless and ineffective therapy. All of the drugs, such as thymol, carbon tetrachloride,

and oil of chenopodium, may be dangerous when used for treatment of any helminthic infestation. Maplestone,[10] Evander and Doyle,[9] and others, report that none of these drugs are effective against the trichostrongyles. Furthermore, Evander[9] and his coworkers have found that emetine and carbarsone are likewise without effect.

Workers disagree as to the pathogencity of the trichostrongyle worms for man. Kouri[11] states that they are hematophagus and are capable of causing severe secondary anemia. He is supported in this contention by Faust.[6] Maplestone,[10] however, does not feel that they are especially pathogenic for man. Since there is no agreement in regard to their disease-producing ability, and since they do not respond to any known drug, it is important that laboratory workers learn to differentiate them from hookworms. If the incidence of infestation by them can be established in this country and their biology more fully studied, their role in human disease can then be more clearly evaluated.

Summary

1. The history and findings of an individual suffering from furunculosis and in whom numerous parasites were discovered is reported.

2. Ova of Trichostrongylus sp. were found in addition to other parasites.

3. The importance of distinguishing this parasite from hookworms is stressed.

4. The pertinent literature has been briefly reviewed.

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A SIMPLE COLONY COUNTER

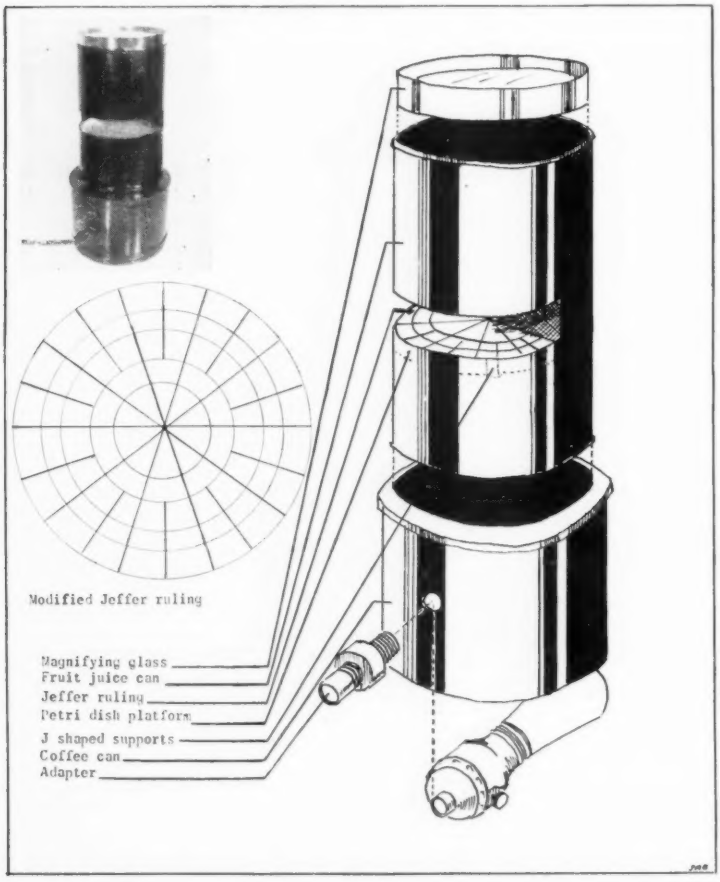
by

Selwyn A. Broitman, B.S. and Joel R. Cohen, M. S.

from the

Department of Bacteriology, University of Massachusetts, Amherst, Massachusetts, and the Department of Pathology, The Springfield Hospital, Springfield, Massachusetts

A bacterial colony counter is not always considered a standard piece of equipment in clinical laboratories. A fair variety of commercially manufactured colony counters is available, but their cost is sometimes considered prohibitory for small laboratories.



A simple bacterial colony counter which can be made up by any laboratory, and which we have found very useful, is herewith reported and demonstrated.

Materials:

1. Tin fruit juice can (403 x 614), diameter $4\frac{3}{16}$", height $6\frac{14}{16}$".
2. Tin coffee can (1 pound size) 4!4 x 308, diameter $4\frac{14}{16}$", height $3\frac{8}{16}$".
3. Light bulb (10 W), socket and adapter.
4. Electrical cord, switch, and plug.
5. Solder.
6. Petri dish cover.
7. Reading glass ($4\frac{1}{8}$" in diameter).

Procedure: (See illustration)

After the ends of the fruit juice can are removed, an opening is cut at approximately $3\frac{1}{4}$ inches from the top, $\frac{3}{4}$ inches in width, and extending through half the circumference of the can. Three $\frac{1}{2}$ inch J shaped supports are fashioned from scrap tin and soldered equidistantly about the inside circumference of the can just below the bottom line of the opening. These serve to hold a petri dish cover which acts as a platform on which the plates to be counted can rest.

A circular opening equal to the diameter of the fruit juice can is cut slightly off-center on the bottom of the inverted coffee can. The fruit can is set on top of this opening and the cans are soldered together. Additional support can be effected by reinforcing this junction with a metallic putty. A $\frac{1}{2}$" hole is drilled midway on the side of the coffee can acting as a base, through which an electrical socket and adapter are installed, with the head of the bulb positioned directly under the off-center opening. A toggle switch may be placed on the cord leading from the bulb, and a magnifying glass fitted over the top. For convenience, the pattern of a Jeffer or Wolffhuegel ruling may be drawn in India ink on thin paper and cemented to the underside of the petri dish cover which acts as the platform. This paper also serves as a light-diffusing surface, and reduces the glare of the direct bulb light. Intensity of the light may be altered by placing filter paper of varying thickness on the underside of the petri dish platform. The counter may be painted, if desired, to improve its appearance.

ASMT MEMBERS

See Page 155

EDITORIAL

The Registry of Medical Technologists of the ASCP	The American Society of Medical Technologists
Is located in Muncie, Indiana.	Has its Business and Editorial Office at 25 Hermann Professional Bldg, Houston 25, Texas.
Has NINE MEMBERS, six pathologists and THREE members of the AMERICAN SOCIETY OF MEDICAL TECHNOLOGISTS, the President, President-elect, and the Immediate Past President.	Has 5200 MEMBERS, all of whom have been **certified** by the Registry or who have a degree at least at a Master's level in one of the fields of medical technology.
Is the standard setting and certifying body for medical technologists.	Is the organization to which a medical technologist may voluntarily belong after he has his credentials, as defined above, and has joined an affiliated society of medical technologists.
You CANNOT **JOIN** the Registry. Membership in the Registry is elective by the respective organizations.	You JOINED ASMT by applying for MEMBERSHIP AFTER you had a certificate from the Registry, through your state society or when you qualified through the degree level route.
Your FEE of $2.00 paid by January 1 entitles you to continue to hold a Registry Certificate, and to sign your name with the letters designating the type of certificate you hold.	Your DUES of $8.00 plus your state society dues paid each **JULY 1** entitle you to full MEMBERSHIP privileges, voting and holding office if you are an active member, and all except voting and holding office if you are an affiliate member.
An annual red seal received by registrants actively engaged in medical technology and until they have been inactive for five or more years, after which they receive blue seal as long as the fee of $2.00 is paid. After 10 years, they receive a small gold seal to be placed on the original certificate.	A new member receives a certificate with a large gold seal impressed with the ASMT official seal.
Every Registered Medical Technologist receives a copy of the TECHNICAL BULLETIN monthly.	Every MEMBER OF ASMT receives a copy of the AMERICAN JOURNAL OF MEDICAL TECHNOLOGY every other month (January, March, May, July, September, and November).
Annual MEETINGS of the Board of Registry are held in October in the city where the ASCP meets.	Annual conventions of ASMT are held in June in a different city each year. In 1953 the annual convention will be in Louisville, Kentucky.
The Board of Registry may have committees within the committee and members of the Board of Registry may serve on other committees in their respective organizations or on other joint committees serving both.	The ASMT has ten standing committees (as described in the By-Laws) and the president has the power to appoint other committees as the need may arise, from within the ranks of the society. Members of ASMT may serve on joint committees with ASCP members.
Sleeve emblems, pins, and keys may be purchased from the Registry by those holding certificates.	Automobile emblems may be purchased from ASMT by members only.
The Registrar of the Registry is Mrs. Ruth Drummond.	The Executive Secretary of ASMT is Rose Matthaei, M.T. (ASCP).

EDITORIAL (Continued)

Name and/or address changes of registrants should be sent to THE REGISTRY OF MEDICAL TECHNOLOGISTS of the ASCP, Muncie, Indiana.

Name and/or address changes of ASMT members should be sent both to the Registry and to ASMT.

Membership in ASMT is not required for certification.

Certification by the Registry or a degree at least at a Master's level in one of the fields of Medical Technology **are** required before one can be a member of ASMT.

R. M.

THE GAVEL

As the time draws nearer for our annual meeting and as the interesting announcements from Kentucky become more numerous I hope that many of you will decide that you "just have to" be there. You are going to miss a wonderful convention if you are among those absent. It might take a little effort on your part to attend, but you will be richly rewarded because the convention committees have worked tirelessly in perfecting their plans for a successful convention. Your presence will be an expression of thanks to them for the many hours of work that they have put in so that you will have a well rounded program.

So many things to do, so many places to go, so much to hear, so many friends to see once again, so many new people to meet! Many excellent subjects and outstanding speakers listed for the scientific sessions! Delightful entertainment planned!

In addition to the above, a whole day has been set aside for the workshops. You have asked for more workshops. We have made them available. Your cooperation is needed to make them successful. You might be interested to know that Glassner & Associates will participate in the Public Relations Workshop. It was your generous spirit of cooperation that made the Public Relations counsel possible. Attend the Kentucky meeting and find out what Glassner & Associates has planned to do for us in 1953-54. One thing I am sure we all agree upon—ASMT means Affiliate Societies Molded Together into a national working unit. By good internal as well as good external Public Relations this can be accomplished, and once we have this machinery working at top speed there is no limit to what we can accomplish. Be at Louisville and find out how this can be done!

Many of you have ideas you would like to present either as individuals or as a State Society. If you have not already sent these in to be placed on the Agenda, please send them as soon as possible so that it will be complete in time for the June 1 deadline. There is much business to be taken up at our June meeting. These business matters concern you. Encourage your State Society to send its full quota of delegates so that you will have a voice in the decisions that are to be made. If you are a delegate, be sure to find out what your members want you to do as their representative. This is the only way that the members of this Society will have true representation, and thereby to have a voice in how the business of this Society is handled.

This is the last time that I will have the chance to talk to you before Louisville, since the next issue of the Gavel will find you with a new President. I wish to thank you for the cooperation that you have given to me this year and to solicit that same spirit of cooperation for her. I am sure that you will give it.

Sadie Cartwright, MT(ASCP)

PUBLIC RELATIONS COMMITTEE

Enclosed with the June ASMT News Letter all ASMT members will find a copy of the illustrated Public Relations Handbook. A clear knowledge of these functions has been lacking in our minds. In this respect, for our first public relations project Mr. James Armsey has performed a valuable service to our Society in writing and presenting this handbook for our use. It will help all of us to gain a clearer concept of what public relations is and how it may function to facilitate the communication of ideas and to increase a better understanding of our profession by our allied groups and laymen. Each society should make it "required reading" for all new members. Copies of this are available to you at the nominal cost of $0.10 each or $1.00 per dozen from the Executive Office.

Ellen Skirmont, Chairman
338 S. East Ave.,
Oak Park, Illinois.

MEETINGS

The 4th Annual Meeting of the Texas Association of Blood Banks will be held at the Texas Hotel, Fort Worth, Texas, December 4th and 5th, 1953. For further information write Dr. W. N. Powell, President, c/o Scott & White Clinic, Temple, Texas, or Miss Marjorie Saunders, Secretary, 3500 Gaston Avenue, Dallas, Texas.

The FIRST INTERNATIONAL CONVENTION OF X-RAY TECHNICIANS will be held at the Royal York Hotel, Toronto, Canada, June 28 through July 2, 1953. It will be sponsored jointly by the Canadian Society of Radiological Technicians and the American Society of X-Ray Technicians. There will be eight Refresher Courses presented, four by Canadian and four by American instructors. Contact Beatrice Hurley, R.T., Registrar for St. Catherine Hospital, East Chicago, Indiana, for additional information and advance enrollment. Non members are invited. Guest badges will allow anyone to enjoy the convention activities and social functions.

QUESTIONNAIRE RETURNS

The cooperation of members of ASMT in the return of the Compensation (Standards and Studies) Questionnaire, as well as that concerning the incidence of infectious jaundice (by Dr. Sydney Gellis) is very much appreciated. Out of 5100 distributed, more than 2800 have been returned to the Executive Office.

Dr. Gellis will have a preliminary report to be given by convention time, and the information on compensation will be discussed at length in the committee workshop. With the interest shown in this material, we hope to be able to give our readers a fairly accurate picture of the financial status of the registered medical technologist.

DUES DUES DUES

Annual dues for MEMBERS of the AMERICAN SOCIETY OF MEDICAL TECHNOLOGISTS are NOW PAYABLE for the fiscal year beginning July 1, 1953. Statements have been forwarded to the treasurers of affiliated societies for distribution. Please pay dues for 1953-54 promptly. Those postmarked after September 15, 1953 must be accompanied by a reinstatement fee of $2.00. In order to avoid payment of a reinstatement fee after September 15, a letter of resignation must be submitted direct to the Executive Office by that date. A member reapplying for membership **after resignation** pays his current year's dues only. An application for membership received in the Executive Office between May 1 and July 1 shall be accompanied by one year's dues. These applicants receive up to fourteen months' membership privileges for $8.00. Those applicants whose half year dues are received in the office between May 1 and July 1 will be sent a statement for a balance due of $4.00 in order that they also may have the privilege of "up to fourteen months'" membership privileges.

PLEASE PAY DUES PROMPTLY

SEE ADVERTISING SECTION FOR RESERVATION FORMS

DELEGATES, ALTERNATES, and OTHER MEMBERS: Identification by ASMT MEMBERSHIP CARD required for admittance to HOUSE OF DELEGATES. Take your March, 1953, AMERICAN JOURNAL OF MEDICAL TECHNOLOGY to Louisville for reference.

MORE ABOUT CONVENTION ENTERTAINMENT

Make reservations NOW for the OPENING NIGHT of "The Tall Kentuckian," on June 15th at the Iroquois Amphitheatre. This is a musical drama based on the life of Abraham Lincoln and climaxes weeks of celebration of Louisville's 175th anniversary. Tickets are $2.40. Send your reservations to the Convention chairman: Miss Mary Benedict Clark, 301 McCready Avenue, Louisville, Kentucky.

AND ABOUT THE REGISTRY

Mary Nix says: "Last October it was my privilege and pleasure to visit the Registry Office in Muncie, Indiana. I left with the sincere wish that every Registered Medical Technologist might visit 700 Council Street and observe for themselves. NOW this golden opportunity has been made possible by Mrs. Drummond and Staff who have arranged an OPEN HOUSE for us on June 13 and 19, 1953. Avail yourselves of the invitation. Visit the OFFICE and meet cordial, efficient Mrs. Ruth Drummond and her assistants: Mary Rensell, Lucille Mitchell, Helen Dantz, Martha Fisher, Sarah Johnson, Marianne Miller, Helen Oxley, Ailene Blair and Florence Jamieson. See YOUR REGISTRY® in action."

NOTICE TO THE SISTERS

We know that a large number of our Sister members are making plans to attend the ASMT 1953 annual convention to be held in Louisville, June 14-18. If you have not done so already, send your application for housing reservations to your Hospitality Chairman as soon as possible. The Brown Hotel Managers will reserve a section of the hotel for Sisters if they have sufficient notice. On account of retreats and summer schools, the Superiors of our local convents have asked us to give them early notice of the number of Sisters, who would like reservations in Convents. PLEASE WRITE NOW. We have planned a trip for the Sisters to historic Bardstown for Thursday afternoon. It will include a visit to the Trappist Monastery and to My Old Kentucky Home, and a private dinner in the Bardstown Country Club. The price of the dinner is $1.50, a special rate for Sister guests. Consult the notice under "entertainment" in this issue of the Journal for the cost of the bus trip to Bardstown.

Sister Mary Christine Wedding, SCN,
St. Mary and Elizabeth Hospital,
Louisville, Kentucky.

THE AMERICAN SOCIETY OF MEDICAL TECHNOLOGISTS TWENTY-FIRST ANNUAL CONVENTION

Headquarters
Brown Hotel, Louisville, Kentucky
June 14, 15, 16, 17, and 18, 1953

PROGRAM

SUNDAY, JUNE 14

8:00 A.M. Registration Opens—Lobby
1:00 P.M. Advisory Council Meeting—Roof Garden
2:00 P.M. See Entertainment Program
7:00-9:00 P.M. Reception—Blue Grass Room

MONDAY, JUNE 15

8:00 A.M. Formal Opening of Convention—Crystal Ballroom
Presiding—Sister Mary Simeonette Savage, S.C.N., Specialist (ASCP), Mary Benedict Clark, M.T. (ASCP), Alternate
Invocation—Very Rev. Alfred F. Horrigan, President, Bellarmine College, Louisville, Kentucky
Salute to the Flag—Members of the Boy Scouts of America, Louisville Area.
National Anthem—Miss Betty Eggleton, Ursuline College, Louisville, Kentucky.
Welcome—Honorable Charles P. Farnsley, Mayor, City of Louisville; W. O. Johnson, M.D., Louisville, Kentucky, First Vice-President, Kentucky State Medical Association; W. H. Allen, M.D., Louisville, Kentucky, President, Kentucky Society of Pathologists; Malcolm L. Barnes, M.D., Louisville, Kentucky, Advisor, Kentucky State Society of Medical Technologists.
Greetings—Miss Sadie Cartwright, M.T. (ASCP), President, American Society of Medical Technologists.

8:30 A.M. Formal Opening of the Technical and Scientific Exhibits, Mr. John McConnell, Scientific Products Division, American Hospital Supply Corporation.

WORKSHOPS

Section One—Crystal Ballroom

9:30 A.M. Recruitment Workshop—Chairmen: Sister Barbara Clare Hageman, M.T. (ASCP), St. Patrick Hospital, Missoula, Montana and Mrs. Ruth Drummond, M.T. (ASCP), Board of Registry, Muncie, Indiana.

11:30 A.M. Finance Workshop—Chairmen: Miss Mary F. Eichman, M.T. (ASCP), Philadelphia, Pennsylvania and Miss Kathryn Dean, M.T. (ASCP), U. S. Marine Hospital, Baltimore, Maryland.

2:00 P.M. Public Relations Workshop—Chairman: Miss Ellen Skirmont, M.T. (ASCP), Oak Park, Illinois, assisted by the Public Relations Advisor of ASMT, Mr. Lewis Glassner of Glassner and Associates, Chicago, Illinois, who will be introduced to the members at this time, and by Dr. Charles LeTourneau, American Hospital Association.

4:00 P.M. Membership Workship—Chairman: Miss Eleanor Brenny, M.T. (ASCP), Pensacola, Florida.

WORKSHOPS

Section Two—Roof Garden

9:30 A.M. Standards and Studies, Civil Service and Armed Service Workshop—Chairmen: Miss Dorothy McGhee, M.T. (ASCP), Raleigh, North Carolina and Mrs. Lucille Wallace, M.T. (ASCP), Spokane, Washington.

10:30 A.M. Legislation Workshop—Chairman: Miss Virginia Burris, M.T. (ASCP), St. Paul, Minnesota assisted by Dr. Lall Montgomery, Muncie, Indiana.

4:00 P.M. Constitution and By-Laws, Nominations and Elections Workshop—Chairmen: Miss Rose Hackman, M.T. (ASCP), Denver, Colorado and Miss Constance Peterkin, M.T. (ASCP), Alexandria, Virginia.

Monday Evening—See Entertainment Program.

TUESDAY, JUNE 16

Exhibits Open, 8:30 A.M. to 5:30 P.M.

9:00 A.M. House of Delegates Meeting Convenes—Crystal Ballroom
Presiding—Miss Sadie Cartwright
Parliamentarian—Mr. Athol Taylor, Attorney

12:00 M. Recess

1:00 P.M. House of Delegates Meeting Reconvenes

Motion Picture Films

Derby Room

2:00 P.M. "Glass for Science," courtesy of Corning Glass Works.

2:30 P.M. "Newer Methods of Exfoliative Cytologic Techniques," courtesy of Dr. George Papanicolaou, Cornell Medical College.

3:00 P.M. "Laboratory Diagnosis of Diphtheria," courtesy of U.S.P.H.S., Chamblee, Georgia.

4:00 P.M. "Antibiotics," courtesy of Squibb and Company.

4:30 P.M. "V. D. R. L. Techniques," (film strip), courtesy of U.S.P.H.S., Chamblee, Georgia

WEDNESDAY, JUNE 17

Exhibits Open, 8:30 A.M. to 5:30 P. M.

Section One—Crystal Ballroom

8:00 A.M. Presiding—Phyllis Ogburn, M.T. (ASCP)
Nell Butler, M. T. (ASCP), Alternate
"The Work of the Board of Registry of Medical Technologists"—Lall G. Montgomery, M.D., Chairman, Board of Registry of American Society of Clinical Pathologists, Muncie, Indiana.

8:30 A.M. "Newer Knowledge Concerning Histoplasmosis"—Clayton G. Loosli, M.D., Professor of Preventive Medicine, Chief, Section of Preventive Medicine, Department of Medicine, University of Chicago, Chicago, Illinois.

9:00 A.M. "Laboratory Technics for the Diagnosis of Viral Diseases"—Charles C. Croft, Sc.D., Assistant Chief, Division of Laboratories, Ohio Department of Health, Columbus, Ohio.

9:30 A.M. Visit the Exhibits.

10:00 A.M. "The Bacteriological Diagnosis of Tuberculosis in Children"—Letitia S. Kimsey, M.D., Assistant Professor of Microbiology, University of Louisville School of Medicine, Louisville, Kentucky.

10:30 A.M. "The Interpretation of the Serological Tests for Murine Typhus"—Griffith E. Quinby, M.D., M.P.H., Senior Surgeon, U. S. Public Health Service, Communicable Disease Center, Toxicology Section, Technical Development Laboratories, Savannah, Georgia, formerly Chief, Malaria and Typhus Appraisal Unit, Epidemiology Branch, Atlanta, Georgia.

11:00 A.M. "Principles and Techniques of the Spectrophotometer and the Flame Photometer"—Sister M. Angelice Seibert, O.S.U., Ph.D., Chairman, Division Natural Sciences, Director Research Laboratories, Ursuline College, Louisville, Kentucky.

11:30 A.M. "Quicker Bacteriological Results"—R. H. Weaver, Ph.D., Professor of Bacteriology, University of Kentucky, Lexington, Kentucky.

12:00 M. Noon Recess.

Section One—Crystal Ballroom

1:00 P.M. Presiding—Rachel Lehman, M.T. (ASCP)
Bennie Bargas, M.T. (ASCP), Alternate
"Supravital Hematology"—Robert Jones Rohn, M.D., Assistant Professor of Medicine and Director of Hematological Research, Indiana University School of Medicine, Indianapolis, Indiana.

2:00 P.M. "Newer Data Obtainable from the Blood Film-Methods of Examination and Significance of Findings"—Raphael Isaacs, M.A., M.D., Senior Attending Physician in Hematology, Michael Reese Hospital, Chicago, Illinois.

2:30 P.M. "Recent Advances in Blood Coagulation"—George Y. Shinowara, M.D., Professor, Department of Pathology, College of Medicine, Director, Biochemical Laboratories, University Hospital, Ohio State University, Columbus, Ohio.

3:00 P.M. Visit the Exhibits.

3:30 P.M. "Evaluation of the Glucose Tolerance Test"—A. J. Gabriele, M.D., Private Practice in Internal Medicine, Staff of Miami Valley Hospital, Dayton, Ohio.

4:00 P.M. "Some Legal Aspects of Medical Technology"—Albert Stump, Indianapolis Attorney, Juris Doctor cum laude (University of Chicago), LL.D. (Marietta College), Lecturer on Medical Jurisprudence, Indiana University School of Medicine, Indianapolis, Indiana.

4:30 P.M. "Laboratory Methods for the Demonstration of L.E. Cells"—James T. McMcClellan, M.D., M.S. in Pathology, Lexington Laboratories, St. Joseph Hospital, Lexington, Kentucky.

5:00 P.M. "A Spectrophotometric Method for Bromsulfalein in Normal, Jaundiced and Lipemic Serium"—Nelma Forsythe Maclay, M.T. (ASCP), Chief Chemist, Methodist Hospital, Indianapolis, Indiana.

WEDNESDAY, JUNE 17

Exhibits Open, 8:30 A.M. to 5:30 P.M.

Section Two—Roof Garden

8:30 A.M. Visit the Exhibits.

9:00 A.M. Presiding—Mary Gauvey, M.T. (ASCP)
Mary Graft, M.T. (ASCP), Alternate
Round Table Discussion: Blood Grouping Technics in Clinical Medicine
1. "Test for the Diagnosis and Prognosis in Erythroblastosis Fetalis"—Helen J. Madden, B.S., M.T. (ASCP), Blood Grouping Laboratory, Boston, Massachusetts.

2. "Indirect Coombs Compatibility"—Jane M. Haber, Serologist, Central Laboratories, New York Hospital, New York.
3. "The Trypsin-Modified Cell Technic for Detection of RH Antibodies"—Jane Frances Taylor, M. S., M.T. (ASCP), Research Assistant, The Children's Hospital, Columbus, Ohio.

10:30 A.M. "Electrocardiograms"—Sister Mary Antonia, S.C.N., B.S., M.S., M.T. (ASCP), Laboratory Supervisor, St. Joseph Infirmary, Louisville, Kentucky.

11:00 A.M. "Blood Volume Studies with Radioactive Isotopes"—Bernice Koster, B.S., M.T. (ASCP), Blood Bank, Firmin Desloge Hospital, St. Louis, Missouri.

11:30 A.M. "Practical Considerations on the Use of Radioactive Iodine (I-131) in Thyroid Disorders"—Robert Willmott, M.S., Staff Physicist, Good Samaritan Hospital, Lexington, Kentucky.

12:00 M. Noon Recess.

Section Two—Roof Garden

1:00 P.M. Presiding—Mary Frances James, M.T. (ASCP)
Marcus Allen, M.T. (ASCP), Alternate
"Diagnostic Methods in Endocrinology"—Edna H. Sobel, M. D., Research Associate University of Cincinnati, College of Medicine, Children's Hospital Research Foundation, Cincinnati, Fels Research Institute, Antioch College, Yellow Springs, Ohio.

1:30 P.M. "The Isolation and Identification of Enteric Bacteria"—Mrs. Aileen Burge Wright, A.B., M.T. (ASCP), Bacteriologist, Jacksonville State Hospital, Jacksonville, Illinois.

2:00 P.M. "Methods for the Isolation of Pathogenic Fungi from Clinical Material"—Margaret Hotchkiss, Ph.D., Department of Bacteriology, University of Kentucky, Lexington, Kentucky.

2:30 P.M. "Effect of the Hospital Staff-Technologist Relations on Patient Service"—Sister Mary Carmelita, O.S.F., M.T. (ASCP), St. Francis Hospital, Maryville, Missouri.

3:00 P.M. "The Need for More than 'Routine' Microbiology"—Albert Balows, M.S., Ph.D., Staff Microbiologist, St. Joseph Hospital and Lexington Clinic, Lexington, Kentucky.

3:30 P.M. "Blood Viscosity in Normal and Dehydrated Persons"—Gorden S. Starkey, M.S., M.T. (ASCP), Assistant Director, The Myers Clinic Hospital Laboratory, Philippi, West Virginia.

4:00 P.M. "Pancreatic Function Tests: Methods and Clinical Usefulness"—Arthur M. Schoen, M.D., University of Louisville School of Medicine, Louisville, Kentucky.

4:30 P.M. "Sulfated Dextran-Blood Anticoagulant Activity and Toxicity Studies in Animals"—Hartzel G. Payne, M.T. (ASCP) and Philip J. Baker, Jr., Ph.D., Pharmaceutical and Chemical Research Division, Commercial Solvents Corporation, Terre Haute, Indiana.

THURSDAY, JUNE 18

Exhibits Open, 8:30 A.M. to 1:00 P.M.
Section One—Crystal Ballroom

8:00 A.M. Presiding—Nila Maze, M.T. (ASCP)
Mary Frances Gridley, M.T. (ASCP), Alternate
"The Isolation and Identification of the Dermatophytes"—Leanor D. Haley, Ph.D., M.T. (ASCP), Assistant Professor, Medical Microbiology, Yale University School of Medicine, New Haven, Connecticut.

8:30 A.M. "Prothrombin Time"—Opal E. Hepler, M.D., Associate Professor of Pathology, Northwestern University Medical School, Director of Clinical Laboratories of Pasavant Memorial Hospital and Northwestern University Montgomery Ward Clinics, Chicago, Illinois.

9:00 A.M. Visit the Exhibits.

9:30 A.M. "Clinical and Laboratory Diagnosis of Superficial and Deep Fungous Diseases"—James H. Gosman, M.D., Assistant Professor of Dermatology, Syphilology, Indiana University Medical School, Indianapolis, Indiana.

10:30 A.M. "Experiments with Commercial Beet Juice as a Component of Culture Medium"—Nancy Lu Conrad, B.S., M.T. (ASCP), Bacteriologist, Ohio State University Hospital, Columbus, Ohio.

11:00 A.M. "New Studies in Trichinosis"—J. M. Edney, Ph.D., Acting Head, Zoology Department, University of Kentucky, Lexington, Kentucky.

11:30 A.M. "Preparation of Material from Hematopoietic Organs for Morphologic Studies"—Lawrence Berman, M.D., Professor of Hematopathology, Wayne University College of Medicine, Detroit, Michigan and Elsa S. Kumke, B.S., M.T. (ASCP). Miss Kumke will read the paper.

12:00 M. "Laboratory Aids in Chest Diseases"—Matthew Darnell, Ph.D., M.D., Staff of St. Joseph Hospital, Lexington, Kentucky.

THURSDAY, JUNE 18
Exhibits Open, 8:30 A.M. to 1:00 P.M.
Section Two—Roof Garden

8:00 A.M. Presiding—Anna Bell Ham, M.T. (ASCP)
Mrs. Anna E. Dickson, M.T. (ASCP), Alternate
"Lymphocytoses"—Sister Mary Alcuin Arens, O.S.B., M.S., M.T. (ASCP), College of St. Scholastica and the Clinical Laboratories of St. Mary Hospital, Duluth, Minnesota.

8:30 A.M. "Some Recent Studies in Diabetes"—William Douglas Lotspeich, Ph.D., Professor of Physiology, College of Medicine, University of Cincinnati, Cincinnati, Ohio.

9:00 A.M. "Exfoliative Cytologic Techniques with Special Consideration of the Newer Methods"—Charlotte M. Street, B.S., Chief Technologist, Papanicolaou Cytology Laboratory, Cornell University Medical College, New York, New York.

9:30 A.M. "Eliminating the Old Phonies in Clinical Laboratory Techniques"—Mervin H. Grossman, M.D., Pathologist and Director of Laboratories, Memorial Hospital, Chattanooga, Tennessee and Louis B. Smith, M. D., Pathologist and Director, St. Paul Hospital, Dallas, Texas.

10:30 A.M. Visit the Exhibits.

11:00 A.M. "The Determination of Acid and Alkaline Phosphatase Using p-Nitrophenyl Phosphate as Substrate"—Anne J. Sommer, B.S., M.T. (ASCP), Instructor Biochemistry, Firmin Desloge Hospital, St. Louis University, St. Louis, Missouri.

11:30 A.M. "A Discussion of Blood Amylase Methods"—Mildred Rose Talluto, B.S., M.T. (ASCP), Department of Pathology and Clinical Laboratory, Rochester, New York.

12:00 M. "The Accuracy of Urine Sugar Tests"—A. S. Giordano, M.D., South Bend Medical Foundation, South Bend, Indiana, Alfred H. Free, Ph.D., The Miles-Ames Research Laboratory, Elkhart, Indiana, and Marion H. Cook, B.S., M.T. (ASCP), The Miles-Ames Research Laboratory, Elkhart, Indiana.

ENTERTAINMENT PROGRAM

SUNDAY, JUNE 14

2:00 P.M. Sightseeing tour of Louisville
2:30 P.M. Sisters' Reception at St. Joseph Infirmary
7:00 P.M.-9:00 P.M. Reception: Blue Grass Room. Host—The Kentucky State Society of Medical Technologists

MONDAY, JUNE 15

8:00 P.M. Harness Races, Fairgrounds or "The Tall Kentuckian," Iroquois Amphitheater

TUESDAY, JUNE 16

8:30 A.M. Trips to Louisville Industrial Plants
12:00 M. House of Delegates Luncheon

WEDNESDAY, JUNE 17

7:00 P.M.-9:00 P.M. Buffet Supper—"Stephen Foster Melodies,"—Root Garden

THURSDAY, JUNE 18

2:00 P.M. Trip to Historic Bardstown
8:00 P.M. Annual Banquet—Crystal Ballroom
Toastmaster—Malcolm L. Barnes, M.D.
Guest Speaker—O. O. Miller, M.D.

SCIENTIFIC EXHIBITS

Colorado State Society of Medical Technologists.....Booth 35
Minnesota Society of Medical Technologists.....Booth 36
Florida Division of ASMT.....Booth 37
Kentucky State Society of Medical Technologists.....Booth 38
American Society of Medical Technologists (Recruitment, Vocational Guidance, and Membership).....Booths 40-41
Registry of Medical Technologists of the ASCP.....Booth 42
Special Staining Techniques in Histology (Mary Frances Gridley) (Armed Forces Institute of Pathology).....Booth 46
A Study in Mycology (Indiana Society of Medical Technologists).....Booth 43
Therapeutic Nutrition (Nazareth College, Louisville, Kentucky)..Booth 53
Activity of The New Jersey Society of Medical Technologists (20th Anniversary—1933-1953).....Booth 55
Ohio Society of Medical Technologists.....Booth 57
The Pennsylvania Society of Medical Technologists and Laboratory Technicians.....Booth 58
Determination of Prothrombin Time (Opal E. Hepler, M.D.)....Booth 59

TECHNICAL EXHIBITS

ORTHO PHARMACEUTICAL CORPORATION — Booth 1

Raritan, New Jersey

Ortho cordially invites you to booth 1 where the complete line of Ortho diagnostic reagents will be on display. Featured will be the Ortho line of blood typing sera including Anti-Rh, Anti-Human, Anti-Hr and Blood Grouping Sera.

BALTIMORE BIOLOGICAL LABORATORY — Booth 2

Baltimore, Maryland

Products for the bacteriological laboratory will be exhibited. A colorful display of interesting cultures will be included, and new kits of prepared culture media will be available for examination; these are in addition to the regular line of dehydrated culture media. Company representatives will be present to furnish information on all items including apparatus and equipment.

AMERICAN OPTICAL COMPANY **Booth 3**
Buffalo, New York

The Instrument Division of the American Optical Company will display instruments of interest to the medical technologists. Among them will be the Medical, Pathologist, Phase and Scholar's Microscopes. These microscopes are designed with features of value in obtaining rapid and accurate microscopic results. The Adjustable Laboratory Illuminator and Advanced Laboratory Illuminator will be shown, which are designed for phase, photomicrographic and research illumination. A portable projector, the MC Delineascope, for color slides or slidefilm, will be demonstrated. At the booth you will find AO Hematological Equipment—the pocket-size Hb Meter and Bright-Line Haemacytometer. Make Booth 3 your first stop.

C. W. ALBAN & COMPANY **Booth 4**
St. Louis 4, Missouri

Demonstration of PERMAPLASTIN for prothrombin time determination. Latest pubications of all publishers on books for the laboratory technologist. A display of latest equipment and supplies for laboratory techniques.

E. LEITZ, INCORPORATED **Booth 5**
New York, New York

Will display its latest model medical microscopes and will feature the popular Leitz-Rouy Photrometer (colorimeter) which is **precalibrated** for forty of the most common clinical determinations.

LOUIS C. HERRING & COMPANY **Booth 7**
Orlando, Florida

Exhibit will show raw minerals from which ADSORMONE is prepared. Method of using ADSORMONE will be demonstrated. Advantages of using urine concentration methods will be presented by means of statistics and specimens from test animals. Photographs will show scenes from the manufacturing and research laboratories. Opportunity will be afforded technologists to consult with Mr. Herring regarding the use of ADSORMONE and the preparation of specimens for testing.

P. LORILLARD COMPANY **Booth 8**
New York, New York

P. Lorillard Company, manufacturers of OLD GOLD and EMBASSY Cigarettes as well as BRIGGS Pipe Mixture and other famous tobacco products will exhibit and demonstrate their new KENT Cigarettes with the exclusive Micronite Filter, which takes out up to 7 times more nicotine and tars than any other leading filter cigarettes.

CORNING GLASS WORKS **Booth 9**
Corning, New York

A complete line of Pyrex brand laboratory glassware for use of the Medical Technologist, including pipettes, petri dishes, culture tubes, micro cover slides, fritted bacteria filters, reagent bottles, cylinders, graduates and funnels will be shown.

NATIONAL ANALINE DIVISION,
ALLIED CHEMICAL AND DYE CORPORATION
New York, New York **Booth 10**

An unusual display of their complete line of biological stains and indicators includes biological stains, water soluble indicators, Clark and Lubs indicators and oxidation-reduction indicators.

THE DENVER CHEMICAL MFG. CO., INC. **Booth 11**
Denver, Colorado

Albumin Test Denco—the new filter funnel method for detection of albumin will be featured at our booth. You are invited to see demonstration of this new principal in detection of albumin in urine and other body fluids. Other Denco products on display—Sugar Tex Denco (Galatest) and Acetone Test Denco.

MEINECKE & COMPANY, INC. **Booth 12**
New York, New York

On display and demonstration will be Haemo-Sol, the truly outstanding chemical preparation specifically designed for the cleaning of scientific apparatus such as laboratory glassware, syringes, etc. Haemo-Sol is entirely free rinsing, leaving no film or residue to interfere with subsequent titrations. Moreover, Haemo-Sol prevents any etched condition on glassware. Also, it has been found that Haemo-Sol is the ideal preparation for use in connection with a Flame Photometer.

KIMBLE GLASS COMPANY **Booth 13**
Toledo, Ohio

Kimble Glass Company, Toledo, Ohio, a subsidiary of Owens-Illinois Glass Company, will exhibit a representative selection of Kimble Laboratory Glassware including volumetric and calibrated apparatus. Products bearing the well-known "EXAX," "NORMAX" and "K" Brand will be included. Also, the new line of permanent-filled Kimble thermometers will be displayed.

THE COCA-COLA COMPANY **Booth 14**
New York, New York

Ice cold Coca-Cola served through the courtesy and cooperation of the Coca-Cola Bottling Company of Louisville, Incorporated and the Coca-Cola Company.

FISHER SCIENTIFIC COMPANY **Booth 15**
Pittsburgh, Pennsylvania

Fisher Scientific Company will display their New Slide Warmer, New Seriological Water Bath, their Certified Reagent Line of Chemicals, Unitized Furniture, and their Clinical Electro-Photometer plus other equipment of interest to the Medical Technologist.

ARTHUR H. THOMAS COMPANY
Philadelphia, Pennsylvania **Booth 16**

Will exhibit new Polethylene wash bottles, stopcock tension clips, Eosinophil counting chamber, new pipette shaker, Sunderman conductivity outfit for the calculation of serum total base, new tissue grinder with teflon pestle, Lapatie tissue grinder, tissue flotation bath, hand microtome knife sharpener, new paper electrophoresis apparatus.

THE COLEMAN & BELL COMPANY **Booth 17**
Norwood, Ohio

The Matheson Coleman & Bell, Inc. (formerly the Coleman and Bell Co.) now has the facilities for filling practically all the reagent requirements of the average clinical laboratory and such items can be obtained from one source. Since the merger of the Coleman and Bell Co. with the Matheson Company of East Rutherford, N. J., there are more than 4000 items including Reagent organic and inorganic chemicals, Biological stains, dry and in solution, Diagnostic solutions, Mounting Media and Test Papers. We will have representatives present to demonstrate the technique employed in the blood staining field. We also plan to demonstrate our new Histowax which has unique properties for tissue embedding.

DIFCO LABORATORIES **Booth 18**
Detroit, Michigan

The Difco exhibit will consist of a display of clinical laboratory reagents and standardized culture media and reagents for micro-biological procedures. This will include media for the primary isolation and identification of pathogenic microorganisms, most commonly employed for culturing organisms associated with blood and respiratory and enteric infections, as well as fungus diseases. Reagents for Tissue and Virus Culture will also be on display.

Reagents for clinical laboratory procedures will include Bacto-Streptolysin O Reagent, Bacto-Sensitivity Disks, Bacto-Guinea Pig Kidney Antigen, Bacto-Beef Cell Antigen, Bacto-Penase, Cardiolipinlecithin and lipoidal antigens for the sero-diagnosis of syphilis, Bacto-Thromboplastin, Bacto-Cephalin Cholesterol Antigen, Bacto-Thymol Turbidity Reagent and Phenolsulfonphthalein. The new Ninth Edition of the Difco Manual will be available for distribution.

J. MELVIN FREED, INCORPORATED **Booth 19**
Perkasie, Pennsylvania

Our display will be Microscope Slides made of our exclusive water white glass, precision cut and ground, will meet all requirements of Federal Specifications. Culture Slides, each depression individually and uniformly ground and polished. Special slides made as requested.

"Scopak," a convenient combination package of microscope slides and cover glass. "CORNING" Brand Optical Cover Glass, a sheet drawn glass of optical quality, controlled thickness, free of bubbles, seeds or striae. Meets tests of Federal Specifications and independent laboratories.

HYLAND LABORATORIES **Booth 20**
Los Angeles, California

Modified Owren Prothrombin Test, an improved method which eliminates several error-causing variables in making prothrombin determinations will be featured. Special emphasis will also be placed on Hyland's Anti-Hemosphilic Plasma, a specially processed human plasma used to return the clotting time of hemophilic blood to normal. Hyland's complete line of blood grouping and Rh typing serums and related blood diagnostic reagents will also be shown.

SCHIEFFELIN & COMPANY **Booth 21**
New York, New York

Schieffelin & Co. will exhibit their stable thromboplastin solution SOLU-PLASTIN. Representatives E. H. Williams and J. W. Nelson will demonstrate its simplicity of preparation and its dependability of action. SOLU-PLASTIN has proven to be an accurate and economical means of determining a patient's prothrombin time. Also in the exhibit will be Schieffelin & Co.'s new oral anticoagulant, DANILONE. This is a new product not related to coumarin compounds and possessing many advantages over presently existing oral anticoagulants. Samples and literature will be available to all members.

KAY SURGICAL, INCORPORATED **Booth 22**
Memphis, Tennessee

The Scientific Division of Kay Surgical, Incorporated will present for your consideration and questions the very latest in Basal Metabolism machines, including the revolutionary Jones Air Basal. We hope to meet and greet our many technologist friends at Booth 22.

LIPSHAW MANUFACTURING COMPANY **Booth 23**
Detroit, Michigan

The Lipshaw Manufacturing Company exhibit will be of special interest to the tissue technician. We will display our new N.37 Rotary Microtome, the Diamond Automatic Microtome Knife Honing Machine and our complete line of microtome knives, tissue dehydrating and embedding apparatus and numerous other items for the histologist.

AMES COMPANY, INCORPORATED **Booth 24**
Elkhart, Indiana

ICTOTEST is the latest addition to the Ames family of outstanding diagnostic tablet tests. Performed in less than a minute, it requires no preparation of reagents, no corrosive liquids or equipment. It can be performed in hospital, clinic, office, or home. ICTOTEST determines bilirubin only. A positive reaction with ictotest may be the earliest and sole indication of hepatic disorder or obstruction of the common bile duct. Ames representatives will be happy to demonstrate any or all of the five Ames diagnostic tablet tests.

E. H. SARGENT & COMPANY **Booth 25**
Chicago, Illinois

E. H. Sargent & Company will exhibit a new model Blood Gas Apparatus—Manometric, Van Slyke-Neill, Sargent No. S-7325. Many new features are included. In addition we will exhibit protein and specific gravity apparatus for blood and body fluid, flame photometer and several microscopes.

CLAY-ADAMS COMPANY, INCORPORATED **Booth 26**
New York, New York

The Clay-Adams Company will exhibit new developments in the clinical laboratory field. Notable among them will be new models of the Yankee Rotators with direct speed setting dials, a slide rule anemia classifier (blood sonstants calculator), a new 10 unit rack for the Wintrobe Blood Sedimentation test and a new Wintrobe Pipette. A Yankee Kahn Test Shaker, centrifuges and other specialties.

AMERICAN HOSPITAL SUPPLY CORPORATION **Booths 27, 28, 29**
Evanston, Illinois

American Hospital Supply Corporation will have on display the complete line of Baxter Intravenous Solutions and accessory sets, including the new electrolyte solutions. Complete descriptions and indications for these new solutions are now available. Also on display will be Dade Grouping and Typing Serums, Markham Bacteriological Antigens, Sylvana Serology Antigens, A Beckman Model B Spectrophotometer and flame attachment in actual operation, the Haemoscope for rapid red cell counts, our Venipuncture Training Arm, and many new time-saving clinical laboratory items.

COOPERATIVE BOOK BOOTH **Booth 30**

This exhibit will give you the opportunity to scan at will the newest volumes published by The Blakiston Company,
The University Press, Inc.,
The National Press,
W. B. Saunders Company,
Charles C. Thomas, Publisher,
Little, Brown and Company,
The Year Book Publishers, Inc.,
Harvard University Press, and
Oxford University Press, Inc.